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PREREQUISITES FOR THE INTEGRATED DEVELOPMENT OF THE SECONDARY WOOD-PROCESSING INDUSTRY*

Prepared by the
UNIDO Secretariat

*Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). This document has not been edited.

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Introduction

1. The secondary wood processing industry transforms primary products such as sawn timber, plywood, panels, etc., into finished products or their parts.

2. The world output of wood, cork and primary wood products is estimated to be 128 billion US dollars (1985). The share of developing countries in the world output is around 10% of this figure.

3. For the furniture industry alone, the world output is estimated at 84 billion US dollars (1985), of which less than 9% originated in the formal sector of developing countries.1/ It must be recognized, however, that the vast majority of developing countries' production is still in the informal sector.

4. Wood and wood manufactured products processing is a very important subsector in the world economy in terms of employment and value-added. It accounts for about 5 percent of the world's total manufacturing employment. In developed economies the value-added generated by the wood and wood processing subsector is assumed to be 4.2 percent of the total manufacturing value-added. In developing countries it is estimated at 3.7 percent.

5. As manpower is an important component in the structure of furniture manufacturing value-added, there are many opportunities to increase exports from developing countries. The share of Asian exports in 1987 accounted for 7% of total world exports and it continues to grow fast. Latin America, with an enormous potential, accounts for some 2% of world trade.

6. This paper summarizes the prerequisites discussed during the preparatory expert group meeting, for fast-growing development of the secondary wood-processing industries in developing countries.

Policy and strategy formulation

7. In most countries it is not uncommon that responsibility for the management of the whole wood sector is dispersed among various ministries and departments. As a consequence, policies for the development of the secondary wood-processing sector are often not co-ordinated with those concerning forest resources development and/or primary industries development and other industrial sectors.

8. Master plans could be useful tools to foster the establishment of intersectoral industrial relations leading to co-ordinated policies and strategies to develop the sector.2/

1/ UNIDO Handbook of Industrial Statistics, (1988).

2/ DP/CMR/83/001 Cameroon - Assistance in the Formulation of an Industrial Master Plan.

9. In Malaysia the Industrial Master Plan (IMP), (1986) for the wood-based industry proposed a rationalisation of the primary processing industry in Peninsular Malaysia and the setting up of "timber processing zones" in Sabah and Sarawak. The establishment of "timber processing zones", which would cover sawmilling as well as further processing activities, is expected to facilitate the development of secondary processing in both these States.

10. The furniture and moulding sectors are targeted in the IMP to lead the growth in the wood-based industry. In the furniture sector, an average annual growth rate of furniture exports of 16.75% and 42.75% were targeted for the periods 1986-1990 and 1991-1995 respectively. In the case of moulding and joinery exports, the projected average annual growth rates are 8.90% and 22.45% respectively for 1986-1990 and 1991-1995. The relevant Government agencies are expected to work closely with the private sector in order to achieve the targeted growth.3/

11. As shown in Table 1, there was an annual growth of 38% in exports of furniture and joinery during the period 1986-1989.

Table 1

Exports of wood and wood products from Malaysia

Value: in '000 US dollar
Volume:in '000 m^3

	1986		1987		1988		1989	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Logs	18,995	1,055,528	22,853	1,569,652	20,571	1,485,836	21,100	1,613,161
Sawn timber	2,991	457,687	3,829	622,290	4,102	695,711	5,115	1,086,836
Plywood*	452	104,687	718	177,363	818	245,551	915	266,525
Veneer	405	28,679	492	38,105	210	44,056	248	54,123
Mouldings	n.a	86,046	n.a	116,536	n.a	151,880	n.a	192,387
Furniture**	n.a	10,210	n.a	20,906	n.a	34,761	n.a	63,438
Joi. ry	n.a	6,510	n.a	12,464	n.a	26,861	n.a	12,280

Figures are based on exchange rate
of 1 US$ = M $ 2.7

* Plywood includes blockboard and laminboard
** Furniture includes rattan furniture

Source: Malaysian Timber Industry Board (1990)

3/ DP/MAL/79/001 Malaysia - Preparation of Medium and Long-term Industrial Master Plans.

12. Many of the timber-rich ASEAN nations have adopted policies and are now implementing programmes to attain faster development of their furniture and joinery industries.

13. Indonesia, for instance, has imposed prohibitively large export duties on sawn timber and is implementing programmes to develop primary and secondary transformation of wood. During the period 1980-87, exports of primary products (plywood) increased at an average annual rate of 56%, and the exports of furniture and joinery at an annual average rate of 86%. In 1987, the country exported raw rattan valued at US$ 230 million but changed the policies to stop exports of poles and encourage exports of furniture. Today, over 100 cane and rattan furniture factories are expanding and exports are increasing rapidly.

14. Taking into account the commitment of the member countries of the International Tropical Timber Organization (ITTO) to an environmentally-sound sustainable tropical forest management by the year 2000, integrated master plans should formulate policies and strategies to develop primary and secondary wood processing industries producing higher value-added products in order to use more efficiently the resources generated by environmentally managed natural or plantation forests in these countries. It must also be recognized that the management of tropical forests poses greater problems than temperate forests.

Technology

15. In industrialized as well as in developing countries, there is a need for continuous improvement and development of existing technologies as well as introduction of new technologies. In fact, this process may be accelerated due to the following reasons:

- As a result of the increased demand for wood, the supply of timber is changing. The most well-known tropical species are becoming scarce. New species hitherto commercially unknown or regarded as less suitable are entering the market. It will be necessary to introduce and adapt technologies to suit the physical characteristics of these new species or even to develop new ones.

- Demands for an environmentally sustained timber supply are growing and, undoubtedly, the cost of the new forest management programmes will increase the price of logs in the tropics. To cope with this trend, the secondary wood-processing industry will have to use increasingly sophisticated technologies to improve yields in its use of expensive raw material. More elaborate construction methods may also be necessary.

- Environmental problems may also lead to a ban on well-known preservatives and formaldehyde resins and their replacement by new, more environmentally-friendly chemicals. New technologies may also be required for their application. In addition, a more elaborate structural design of wood products will be required to increase their built-in protection.

- The increased cost of raw material may be partially offset by productivity gains in the manufacturing industry. For instance, wood furniture is in quality/price equilibrium with respect to plastic or metal furniture. If the price of the former rose extensively, the latter could substantially increase its share of the market.

- To remain competitive, the secondary wood processing industry will need to introduce new technologies as has been done by other assembling industries. These technologies should be introduced not only in production equipment but also in the management of production and in the design of products.

- The existence of these new technologies, many of them already in use in developed countries and some now emerging, poses a special problem for developing countries namely: the assessment of their transferability and eventual suitability. Industrial research, development and training centres located in developing countries could play an important role in this process of assessment, transfer and introduction of new technologies.

Human resources

16. Training of key personnel in wood manufacturing enterprises, especially those in developing countries, is needed in, among others, the following areas:

- All aspects of general, financial, personnel and marketing management with special emphasis on the management of small and medium-scale industries
- Cost evaluation systems
- Product development for serial production
- Production technology including equipment selection, plant layout, etc.
- Production management as applied to serial production
- Use and maintenance of plant machinery and tools
- Identification of species and grading of timber and panels
- Special techniques for processing CLAS
- Wood drying
- Wood preservation
- Integrated quality control systems and procedures for serial production
- Occupational health and safety
- Environmentally safe production processes, waste extraction and disposal
- Packaging, including design of packages and selection of packing materials.

17. In today's economies, industries have to be flexible enough to react quickly to changes in technology, consumer tastes, markets, etc. Obviously, this implies a continuous change in skill requirements. It is evident that it is the industry itself that is in the best position to assess its present requirements. It is certainly difficult to forecast future needs, and assistance from technologists, management consultants, marketing specialists, scientists, etc. outside the industry could be necessary.

18. Combined efforts by public and private institutions as well as on-the-job training by industry and equipment suppliers could reasonably fulfil training requirements, provided these institutions are flexible enough to adapt to continuous changes.

19. Paid on-the-job training could be improved to permit employers to get an adequate return on their investment - trainees often leave after the training period - and trainees to have their rights protected. On the other hand, government training institutions, study tours, etc., could be partially financed by the end users through a tax system calculated on the wages the industry pays. Industry should be adequately represented in the management board of training institutions to ensure that the training programmes reflect the industry's real needs and priorities. For instance, in some Asian countries the establishment of product development and design centres has made consultancy services in furniture design and product development available to the small and medium-scale enterprises which they would otherwise not be financially capable to afford.

20. Different forms of nurturing new small-scale industries like "business incubators", already increasingly popular in developed countries, could and should be promoted in developing countries.

Standards and quality control

21. The importance of standards and quality control in manufactured wood products cannot be underestimated. Unlike the case for primary products - for which standards have been accepted long ago - quality is built into a manufactured wood product. This calls for an appropriate technology and a trained and conscientious work force.

22. In the case of furniture components, mouldings and similar products, the standards used in the trade are those of the receiver. Although standards exist for furniture, they are seldom specified, except in contract work; and appearance and the supplier's reputation play a relatively important role. One way of enhancing producers' reputations would be the provision of national standards, and an impartial and serious testing and inspection system, leading to a "quality label".

23. The problems related to joinery and structural timber elements are more difficult to overcome, because non-tariff barriers play a bigger role. In countries where timber is accepted in construction the species used are temperate zone softwoods. The standards and prevailing practices of these countries tend to be limiting and do not permit full credit for the additional strength of tropical hardwood. This tends to limit their use in construction. "Deemed to satisfy standards" could overcome this. UNIDO has been instrumental in the creation of CIB Working Group W18B ("Tropical and Hardwood Timber Strength") to allow the interests of the countries producing tropical hardwoods to be aired and taken into account. The standards used are invariably those of the end-user country, and it will be necessary to train product designers familiar with their requirements prior to even envisaging entering these markets. Needless to say, greater use of local timbers in producing countries would inspire confidence in prospective importers. To achieve this, efforts should be made to develop appropriate timber engineering design codes and related standards to promote such structural uses.

Transport

24. The secondary wood processing industry uses processed primary wood products and occasionally logs as raw material imputs for further processing. All of these raw materials come from forests and/or plantations and the cost of transporting them to the intermediate or final users has an effect on the cost of the final products.

25. UNIDO has carried out a background study on maritime transport in order to assess the magnitude of inland and maritime transport costs of logs and primary products, which in Europe is as high as 70% of the CIF price for timber shipped from West Africa. The study, which compares the situation in the main wood-producing sub-regions, namely West Africa and South East Asia, constitutes part of the background documentation for the Consultation.4/

26. For export markets, furniture is usually shipped in containers. This system has increased the safety of shipments and reduced the risk of damage. Good packaging practices are necessary in order to avoid the common hazards encountered in shipping furniture and can also be useful marketing tools. In the case of knock-down furniture, it is customary, in designing components and their packages, to minimize wasted space in the container.

27. Single or multilayer corrugated boards that can provide protection against impact, compression and chipping, are increasingly being produced in developing countries. Polyethylene film, that can provide some protection against atmospheric dangers, is also common. Nevertheless, new technologies such as co-extruded plastic films, could be adapted specially for knock-down furniture that has to be shipped and later reassembled in another physical environment.

4/ Study on Maritime Transport of Wood and Wood Products, ID/WG.506/2(SPEC.), 1990.

28. Many post-sales problems could be avoided with the use of appropriate packaging materials and techniques. Knowledge thereof is vital for exporting countries.

Finance and investment

29. There are still considerable possibilities to make the financing system more effective, transparent and accessible. The problem is often not that of a shortage of funds but the loan and credit conditions that are requested.

30. One bottleneck may be the lack of interest and/or discouragement of potential investors. Steps that would generate more interest in investment include:

- Faster and more transparent evaluation of investment projects by government agencies, banks and other concerned organizations.

- Removal of an excessive number of policies and regulations that are often contradictory. "One stop" offices that grant pioneer status have been a great help.

- Revised investment codes including unambiguous rules and procedures to repatriate foreign investors' profits.

- Availability of qualified manpower at all levels.

- Flexibility in contractual arrangements with labour.

- Government investment in infrastructure, transport and communications.

- Favourable investment climate in terms of social and political stability to reduce investment risks.

31. Many countries seek to increase both employment and the value-added of wood products domestically by encouraging processing rather than the exporting of logs. Export quotas as well as excessive import duties may, however, create inefficient local industries.

32. It is also worth mentioning that distorted incentives may reduce the efficiency of wood processing industries.

33. In many aspects, sustainable forest management is a special case and some incentives could be socially and environmentally justified. The justification for incentives comes from the fact that sustainable forest management provides a public service in terms of wildlife preservation, genetic diversity, etc., as well as in preservation of the resources that are socially useful goods but difficult for the time being, to include in the cost of the timber.

34. Some agencies, in their bid to encourage private participation in the development of wood and wood products industries, have agreed to grant input subsidies on the following:

- Production inputs
- Equipment and facilities
- Extension services
- Tax relief to manufacturing enterprises which grow their own raw materials
- Removal or reduction of import duties on material and equipment required for wood processing
- Establishment of credit schemes
- Spare parts
- Introduction and enforcement of timber grading rules coupled with the maintenance of appropriate production standards to ensure that end users of intermediate wood products obtain the correct quality of raw material
- Suppression of remaining export duties on processed wood products and on rough wood of certain species provided that an adequate reforestation programme be implemented effectively.

Trade and markets

35. Since the mid-1980's there has been a strong growth in the value of OECD trade on furniture and parts thereof.

Table 2

OECD: apparent growth of imports of wood furniture and parts thereof
(SITC 821)
(in millions of United States dollars)

	1983	1984	1985	1986	1987
Total imports of furniture (current prices)	**8,429.1**	**9,361.0**	**10,609.6**	**14,384.9**	**18,375.8**
Average inflation index (1983=100)	100.0	105.2	109.9	112.8	116.4
Imports (at constant 1983 prices)	8,429.1	8,898.2	9,653.9	12,752.6	15,786.8
Annual growth rate (%)		+5.6	+8.5	+32.1	+23.8
Overall growth, 1983-1987 (%)					87.3
Imports from developing market economies					
Imports at current prices	1,114.9	1,399.3	1,661.4	2,202.5	2,990.4
Imports at constant 1983 prices	1,114.9	1,330.1	1,511.7	1,968.3	2,569.1
Annual growth rate (%)		+19.3	+13.7	+30.2	+30.5
Overall growth, 1983-1987 (%)					130.4

Source: UNSO/ITC Comtrade Data Base System.

36. One important fact emerging from these statistics is that while OECD imports from all countries increased by 87%, their imports from developing countries was up by 130 percent. Therefore, developing countries are increasing their share of total exports to the major economies.

Table 3

Share of developing countries in OECD imports of wood furniture
(SITC 821)
(in millions of United States dollars)

	Total imports		of which from developing countries		Share of developing countries in total imports (%)	
Country/Area	1983	1987	1983	1987	1983	1987
European Community	4496	9081	117	264	2.6	2.9
USA	2044	5057	756	2144	36.9	42.4
Other major OECD countries	1872	4189	242	583	12.9	13.9
Total OECD	8429	18376	1115	2991	13.2	16.3

Source: UNSO/ITC Comtrade Data Base System.

37. The generally low level of restrictive measures in major importing countries such as the EEC, which allows almost duty-free entry from all sources, or the USA where tariff rates are free for the GSP beneficiaries, does not explain the increase in the developing countries' share in the USA market and the stagnation, in relative terms, in the EEC markets.

38. This fact suggests that the bottleneck hindering the expansion of exports from developing countries to some OECD markets is not a problem of access but rather relates to aspects of production such as cost efficiency, serial mass production, quality standards, quality control and very important aspects of marketing such as product design, distribution channels, etc.

39. Nevertheless, internal barriers that may apply equally to local producers as well as exporters, exist in the majority of developed and developing countries.

40. When it comes to the promotion of wood utilization as a building material and its marketing, one major constraint appears to be the attitude of the consumer and the threat of substitute products - an important competitive force acting upon all wood products. Negative perceptions of all such products exist in terms of maintenance and weather resistance.

41. A recent study by the American Plywood Association on the effects of the Californian earthquake of 17 October 1989 showed that wood-frame construction built to meet current code provisions performed very well. Besides noting the ability of wood-frame buildings to resist shaking the study pointed out that none of the newer wood-frame buildings, which met the 1973 Uniform Building Code's earthquake provisions, seemed to be damaged. In contrast, masonry buildings, especially those unreinforced, performed poorly due to greater weight and brittleness.

42. In spite of this, a set of legislative barriers as well as increased mortgage rates, higher insurance rates, etc., penalize the use of wood as a building material thereby eroding its competitiveness.

43. On the other hand, in a move initiated by the Republic of Korea and supported by members of the Association of South East Asian Nations (ASEAN), selected tropical products including wood have been proposed for a round of tariff reductions in the current Uruguay Round of Negotiations of the General Agreement of Tariffs and Trade (GATT). This, if agreed upon, would eliminate all import duties on unprocessed tropical wood and eliminate or substantially reduce duties on semi-processed or processed products. Non-tariff measures affecting trade would also be eliminated.

Environmental awareness

44. The Brandt Report "North-South: A programme for survival", published in 1980, mentioned the urgent need for reforestation in developing countries, yet its repeated appeals for greater political recognition of the crisis facing millions of people were ignored. Tropical forests are disappearing at the rate of tens of thousands of square miles a year. A recent study has estimated that the rate of deforestation for closed tropical forests has almost doubled in the last 10 years. The estimate of deforestation for closed forests alone is about 14 million ha per year and if the same rate of increase applies to open forests, total deforestation would be about 22 million ha per year.5/

45. FAO estimates that the annual rate of tropical deforestation is now about 80 percent higher than it was 10 years ago and amounts to 17 million hectares per year.

46. Among the main agents of deforestation are the conversion of forested areas to shifting cultivation, cattle ranching, modern agriculture, the use of wood as combustible, and wasteful commercial logging operations.

47. A sense of crisis is emerging in developing countries as governments recognize that the rapid deforestation represents a waste of valuable resources and severe economic losses. In some cases governments have taken action by banning or suspending logging in certain sensitive areas.

5/ Myers, N., Deforestation Rates in Tropical Forests and their Climatic Implications, Friends of the Earth, London, 1989.

48. In some developed countries, private firms are logging and reforesting. Generally speaking, however, it cannot be expected that private firms reforest on public land either in developed or developing countries except where the right to harvest also stipulates the responsibility to replant. In many tropical areas this system has not produced the expected results due to the high rate of failures in replanted trees and the difficulty in having effective control over reforestation operations.

49. For these reasons, the concept of sustained yield forest management, which implies limited harvesting of two or three trees per hectare and a subsequent period of regeneration (15-20 years) until the next logging, has gained recognition and formal acceptance.

50. Very few tropical forests are currently being managed for sustained productivity but there is a commitment from ITTO countries to do so by the year 2000.

51. As developed countries now realize that it is also in their interest to preserve tropical rainforests, it is expected that co-operative efforts will improve.

52. A number of governments are now strengthening their forest management capability with the help of international organizations. The World Bank and the Asian Development Bank have loans in the pipeline for forest-management improvement in a dozen countries. Most of these loans support forest-policy reform as well as institutional strengthening.

53. International interest in tropical forests has bloomed, accompanied for the first time by a willingness to contribute to their maintenance. However, many problems remain unsolved. Among these is the question of how much can be absorbed by timber for costs of sustainable forest management without loss of competitivity against other materials.

54. Another important question is who will have control over logging operations in the sustainable managed tropical forest. Taking into consideration the increased influence of environmental groups among the consumers, the question of the credibility of tropical forest management is a pertinent one.

55. Preservation of natural forest and development of secondary processing industries are not contradictory objectives. In fact, all available data suggest that it is possible to increase manufactured wood products output, preserving the resources and the environment, if appropriate measures are taken urgently. The objective of this Consultation is to agree with these measures and with their implementation.

Major questions to be discussed

(a) Policy and strategy

56. In view of the widespread concern about deforestation, it has to be envisaged that within the next few years adjustments will be made to limit log output. Government interventions may be necessary to channel the flow of primary products from export to the local secondary processing industry in order to get more efficient utilization of resources in terms of value-added.

57. Accordingly, the viability of the wood industry in developing countries rests on the skill to produce and export value-added products, ensuring the sustainability of resources and the vitality of the primary processing industry.

Questions:

(i) Which policy, based on the experience of some countries which shifted from export of logs to export of further processed products, can be described as successful and what incentives, direct or indirect, financial and non-financial, were utilized?

(ii) What would be the best mechanisms to disseminate information on the success and failures of policies for developing primary and secondary wood processing industries?

(iii) What investments in infrastructure would be necessary?

(b) Technology

58. The secondary wood-processing industry in developing countries is characterized by small- and medium-scale enterprises where lack of specialisation as well as the country's own technology, results in low productivity, poor product quality and inefficiency in raw material utilization. These are vital for production in series for export markets.

59. There is also an urgent need to define or adapt standards for internal and external markets.

Questions:

(i) What level of technology would be most appropriate for the various conditions prevailing in developing countries and how should it be determined?

(ii) How can the above technology be acquired?

60. To increase raw material availability it is not sufficient to rely on existing, known wood resources. A more efficient use of small dimensions and residue utilization is necessary as well as promotion of commercially-less accepted species (CLAS).

Questions:

(i) How can the use of CLAS for secondary wood processing be promoted and through which measures at the level of:

- state and para-state bodies
- foresters
- manufacturers
- specifiers
- technologists
- consumers
- commercial operators?

(ii) Are imported designs and/or production under licence possible and suitable alternatives?

(iii) How can standards for internal and external markets be developed and/or adapted?

(iv) Are research and development institutes a good solution to acquire and diffuse the latest technological developments? Should they include design centres?

(c) Human resources

61. Training needs in developing countries are immense not only in wood manufacturing but also in all aspects of management, marketing and design.

Questions:

(i) What kind of mixture of public and private formal training institutions as well as on-the-job training should be developed and how?

(ii) How should these institutions be financed and what should the respective role of the public and private sector be?

(iii) What form of design education would be the most suitable?

(iv) What type of collaboration in training could be developed between developed and developing countries?

(d) Standards and quality control

62. The importance of standards and quality control cannot be underestimated by either exporters or importers.

Questions:

(i) What role, if any, would a "quality label" for furniture produced in a developing country play in helping to introduce it in developed markets?

(ii) What measures should be taken to increase the acceptability of timber engineered products made from tropical hardwoods in both developing and developed countries?

(e) Transport

63. Transport is a relatively important component in the cost of wood as well as secondary processed products.

Questions:

(i) How can the cost of surface and maritime transport be reduced?

(ii) Are developing countries using effective packaging technologies to minimize damage and lower transport costs? How can these techniques be disseminated?

(f) Finance

64. Local banks and development institutions are generally a valuable source of information.

65. As far as the knowledge of financing sources is concerned, a list of international financial institutions is available. It refers to development banks and provides information on eligibility criteria and financing available.6/ Local sources, mainly development institutions, are usually easy to reach and have a good knowledge of a country's economy.

66. Collateral, such as real estate, assets or personal surety, will be requested in all cases to cover unexpected risks and to facilitate recovery of the credit. Besides, preparation of feasibility studies is essential to attract investments.

6/ UNIDO Industrial Technology Promotion Division, Manual on Technology Transfer Negotiations, Chapter V.7. - Annex.

Questions:

(i) Would it be possible to simplify financial mechanisms?

(ii) How can capabilities of developing countries in this area be improved?

(iii) How can the problem of excessive guaranties be resolved?

(g) Trade and markets

67. As the access to external markets shows a tendency towards the elimination of most of the restrictive measures, efforts could be concentrated on a better knowledge of these markets and on the elimination of other internal barriers especially those that hinder the development of wood as a building material.

Questions:

(i) How can the overall knowledge of potential markets be increased?

(ii) What should be undertaken to ensure that wood is allowed to play its role as a building material by modifying standards, fire regulations, insurance premiums, etc.?

(iii) What promotion campaigns should be carried out and by whom to educate the public on the role of timber in construction?

Annex

UNIDO financing sources for investment and technology transfer, 1989

MULTINATIONAL INSTITUTIONS

International Development Banks

DEVELOPING COUNTRIES

INTERNATIONAL FINANCE CORPORATION (IFC)

1818 H Street N.W.,
Washington D.C. 20433
U.S.A.

Telephone: (202)477-1234-86-200
Telex: ITT 440098
RCA 248423
Cable: CORINTFIN

Shareholders: The IFC is an affiliate of the World Bank (138 member countries)

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1. ELIGIBILITY CRITERIA

Geographical coverage	All developing member countries.
Sector/sub-sector coverage	High priority is given to productive private enterprises, but IFC is ready to support mixed enterprises. Main sectors of intervention are manufacturing, mining, tourism, utilities and agro-industry.
Project sponsor	IFC attaches great importance to the extent of sponsor's participation in share capital.
Other	Government agreement is always required.

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2. FINANCING AVAILABLE

Equity	Minority participation. Preferably less than 25% of share capital. Sale of its investments to private investors, if possible local, whenever can be done on satisfactory terms.
Loans	Currencies: usually USD but may be in other major convertible currencies. Interest rates: vary according to circumstances risk entailed and prospective return. Generally floating, tied to LIBOR plus spread and front end participation fee. Maturity: 7 to 12 years

IFC (continued)

Collateral: usually, government guarantee is not required.

Limits: IFC generally provides a maximum of 25% of project cost. Provides normally between USD 1 million and USD 50 million. Can raise funds from other sources. May invest less than USD 1 million in Less Developed Countries.

Commitment fees: usually 1% per annum on undisbursed portion of the loan.

3. COMMENTS

- Not tied to purchase of specific equipment from a specific country.
- IFC always co-finances project.

MULTINATIONAL INSTITUTIONS

International Development Banks

EUROPE & ACP

EUROPEAN INVESTMENT BANK (EIB)

100 Bd. Konrad Adenauer,
L - 2950 Luxembourg

Telephone: 4379-1
Telex: 3530
Telefax: 43.77.04
Cable: BANKEU

Shareholders: EEC member countries

1. ELIGIBILITY CRITERIA

Geographical coverage	EEC, ACP States and Mediterranean countries
Sector/sub-sector coverage	For ACP States: public and private sector. Priority is given to productive projects in industry, agro-industry, agriculture, mining, energy, tourism, transport and telecommunications.
Industrial partner	International tender for supply of investment items, at least to EEC member countries and ACP States.
Other	Formal agreement of host country's authorities is required.

2. FINANCING AVAILABLE

Risk capital	- Minority equity participations of a temporary nature in enterprises and development banks. - Quasi-capital in the form of subordinate loans (repayable after other bank debts) and conditional loans (linked to fulfilment of certain conditions): - loans to promoters, ACP States and development banks to acquire shareholding in an ACP undertaking. Depending on nature of each project quasi-capital assistance is generally concessionary (often 2% with term of 25 years). Repayments in equal annual instalments. Denominated in ECU but disbursed in EEC currencies. Endorsement of host country's government is required.
Loans	Currency: Loans denominated in ECUs, disbursed in various currencies according to borrower's preferences and Bank's holdings. Loans from EIB's own resources are provided for projects likely to offer an adequate economic return.

EIB (continued)

	Interest rates: market rates. For ACP countries, except for projects in the oil sector, rate is automatically reduced by a 3% interest rate subsidy, financed from European Development Fund resources, which will be adjusted where necessary so that interest rate actually borne by borrower is between 5% and 8%. Maturity: variable, depending on project. Grace period fixed by reference to construction period and funds needed. For industrial projects: 10 to 12 years. For infrastructure projects: 15 to 20 years. Repayments: equal semi-annual instalments. Collateral: guarantee of the State is generally required although other first-class guarantees may be considered. Commitment fee: 1%
Lines of credit	To regional banks and institutions for onlending to projects.
Investment limits	Not exceeding 50% of total investment cost. Minimum scale of project: no definite rule, but if project is considered too small, it may be able to benefit under a global loan by EIB to an ACP State or a national/regional development bank. There are no specific country floor or ceilings, only a total EIB lending limit which, for Lome III, amounts to ECU 1,100 million. Risk capital limit amounts to ECU 600 million.
3. NON-FINANCIAL SERVICES	Risk capital assistance may be used for financing of specific project preparation and development studies. The loan becomes a grant if the study results are negative.
4. COMMENTS	Funds not tied, not related to purchase of equipment in specific countries. No technical assistance provided by the Bank, but financing of assistance in specific projects. EIB monitors implementation of operations financed.

MULTINATIONAL INSTITUTIONS

REGIONAL DEVELOPMENT BANKS

AFRICA

AFRICAN DEVELOPMENT BANK (AfDB)
01 P.O. Box 1387,
Abidjan 01,
Cote d'Ivoire

Telephone: 32 07 11/32 50 10
Telex: 23717/23263
Cable: AFDEV

Shareholders: 50 independant African States and 22 non-regional members

1. ELIGIBILITY CRITERIA

Geographical coverage	All African shareholding countries.
Sector/sub-sector coverage	Both private and public sectors. Not rigidly linked to any specific economic or social sector, but priorities: agriculture, transport, public utilities, industry, mining.
Other	Host government agreement is required in all cases.

2. FINANCING AVAILABLE

Equity

Minority participation in banks or other financing institutions.

Loans

Currency: Amount expressed in Units of Account, Principal and interests of loans repayable in the currency(ies) disbursed by the Bank.

- Loans for specific projects or group of projects, particularly those forming part of a national or regional development programme.

Interest rates: fixed for the term of the loan.

Maturity: 12 to 20 years: grace period of up to 5 years.

Collateral: guarantee of government for all projects.

Statutory commission: 1% minimum

Commitment fee: 1% on undisbursed portion of signed loans.

ARAB BANK FOR ECONOMIC DEVELOPMENT IN AFRICA (BADEA)

P.O. Box 2640,
Khartoum,
Sudan

Telephone:
73647/73709/70495
Telefax: 22248/22739
Cable: BADEA

Shareholders: Member States of the League of Arab States

1. ELIGIBILITY CRITERIA

Geographical coverage	Non-Arab member countries of the Organization of African Unity (OAU) - only countries which have not recognized Israel.
Sector/sub-sector coverage	Infrastructure, agriculture, industry, energy. Priority to projects allowing to develop Arab investment in Africa. Preference to medium size projects (USD 4 to 5 million) and to regional projects.
Industrial partner	Assistance is not tied to supply of equipment from specific country. Usually international bid in African and Arab countries.
Other	Government agreement is required. Project must be part of countries' development plans. Project must be presented by respective government.

2. FINANCING AVAILABLE

Equity	No
Loans	Currency: mainly USD - Loans to specific development projects Interest rates: • for agriculture and poorer countries: 2% • other, depending on country and project 4 to 7%

BADEA (continued)

	- Loans to development financing institutions Interest rate: up to 8% Maturity: 10 to 25 years (average 15), with 3 to 5 years grace Collateral: Government guarantee required
Investment limits	Maximum USD 10 million or 40% of total cost of project.
Other	BADEA can give its guarantee to Arab and African institutions for the obtention of supplementary credits.
3. NON-FINANCIAL SERVICES	Financing available for pre-investment studies as a grant which will be included in the loan if the project is carried out.

MULTINATIONAL INSTITUTIONS

Regional Development Banks

CENTRAL AFRICA

BANQUE DE DEVELOPPEMENT DES ETATS DE L'AFRIQUE (BDEAC)

P.O. Box 1177,
Brazzaville,
Republique Populaire du Congo

Telephone: 81 02 12
Telex: 5306

Shareholders: Cameroon, Congo, Central African Republic, Gabon, Chad, Equatorial Guinea, Banque des Etats de l'Afrique Centrale, France, Kuwait, Federal Republic of Germany, African Development Bank.

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1. ELIGIBILITY CRITERIA

Geographical coverage	All African shareholding countries
Sector/sub-sector coverage	Priority to economic integration projects. infrastructure, agriculture, productive sectors.
Project sponsor	Borrower must have secured at least 20% of project's total financing requirements (25% for industrial projects).

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2. FINANCING AVAILABLE

Equity: Minority participation.
Sale of participation to State or nationals in due time.

Loans: Various currencies. Foreign exchange risk is to be taken by borrower.

Interest rates: depending on sectors.

- Rural development and basic infrastructure: 5.5 to 8%
- Viable infrastructure projects: 7.5 to 11%
- Productive and profitable projects: 8.5 to 12%

Maturity:

Medium-term: 3 to 10 years with a grace period of max. 3 years:

Long-term: 11 to 20 years, with a grace period of max. 7 years:

Short-term: not available

BDEAC (continued)

		Collateral: guarantee of government or of national finance institution. Commitment fee: 0.75% on undisbursed portion of signed loans.
	Investment limits	Minimum: FCFA 100 million (Bank's own commitment) Maxmimum: total investment not to exceed 10% of the Bank's ordinary resources. Specific project: not to exceed 75% of total cost. Equity: not to exceed 10% of authorized capital: total equity participation not to exceed 10% of shareholders' funds
	Guarantees	For projects totalling less than FCFA 50 million, the Bank can give its guarantee to local development institutions.
	Other	Lines of credit to local financial institutions to be on-lent to projects Interest rates: 5.5 to 8.5%
3.	COMMENTS	- Co-financing with national finance institutions. - For private companies, financing request has to be submitted by or via respective government. The Bank can finance small and medium size projects only by lending through local development institutions.

MULTINATIONAL INSTITUTIONS

Regional Development Banks

WEST AFRICA

BANQUE OUEST AFRICAINE DE DEVELOPPEMENT (BOAD)

68 avenue de la liberation,
P.O. Box 1172,
Lome, Togo

Telephone: 21 59 06
21 42 44

Telex: 5289/5336

Shareholders: Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO), Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, Togo, France, FRG, European Investment Bank

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1. ELIGIBILITY CRITERIA

Geographical coverage	African shareholding States
Sector/sub-sector coverage	Priority to rural sector, basic infrastructure, industry. Favours projects of common interest to two countries or more. Public and private sectors
Project sponsor	Financial participation of sponsor is required.

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2. FINANCING AVAILABLE

Equity	Maximum 5% of the Bank's shareholders' funds. Per project, investment not to exceed 25% of capital.
Loans	Currency: FCFA Interest rates: 6.25 to 12% p.a. Maturity: 7 to 15 years, with 1 to 7 years grace Collateral: guarantee of government or acceptable finance institution. Guarantee commission: 1% Commitment fee: 0.50% on undisbursed portion of signed loans

BOAD (continued)

	Lines of credit	To local finance institutions to be on-lent to projects
	Investment limits	Maximum: 10% of Bank's own funds Minimum: FCFA 20 million In general max. investment: - 50% of project cost for industry - 80% for infrastructure & rural development
3.	NON-FINANCIAL SERVICES	Financing available to pre-investment studies and preparation of project. If project is realized, cost of study incorprated in amount ofloan granted by BOAD. Technical assistance (co-operation with international organizations such as UNDP, FAO, Afdb etc.)
4.	COMMENTS	- Co-financing with other finance institutions - Assistance not tied to supply of equipment from specific country

MULTINATIONAL INSTITUTIONS

REGIONAL DEVELOPMENT BANKS

EAST AFRICA

EAST AFRICAN DEVELOPMENT BANK (EADB)

4, Nile Avenue,
P.O Box 7128,
Kampala,
Uganda

Telephone: 23 00 21
Telex: 61.074
Cable: EADEV

Shareholders: Kenya, Tanzania, Uganda, African Development Bank, Barclays Bank PLC, Commercial Bank of Africa, consortium of Yougoslav institutions, Grindlays Bank, Standard Chartered Bank PLC, PK Banken (Stockholm)

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1. ELIGIBILITY CRITERIA

Geographical coverage	Kenya, Tanzania, Uganda
Sector/sub-sector coverage	Preference of regional projects
Other	Respective central Bank's approval is required

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2. FINANCING AVAILABLE

Equity	Not to exceed 10% of shareholders funds
Loans	Currency: loans in local currency permitted, but loans are usually provided in foreign currency. Borrower bears foreign exchange risk. Interest rates: Maturity: 8 years
Lines of credit	To local finance institutions to be on-lent to projects.
Investment limits	EADB cannot finance more than 50% of the net assets of any single company and cannot commit more than 15% of its net worth to any single company.

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3. COMMENTS

Co-financing with other finance institutions

SOCIETE BELGE D'INVESTISSEMENT INTERNATIONL (SBI)

63, rue Montoyer,
B - 1040 Bruxelles

Telephone: (02) 230 27 85
Telex: 25 744 snim
Telefax: (02) 230 87 84

Shareholders - Public sector: 67%
- Private minority interest: 33%

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1. ELIGIBILITY CRITERIA

Geographical coverage	All countries (industrialized and developing)
Sector/sub-sector coverage	Industry, agriculture, agro-industry, mining and services(commercial, technical, transport etc.)
Industrial partner	Belgian or foreign, Industrial partners are expected to share in the project risk and provide management.

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2. FINANCING AVAILABLE

Equity	Minority shareholdings with specific agreements insuring sale of equity holdings after reasonable period of time.
Loans (convertible)	Currency: usually Belgina Francs or other currencies available on international markets. Maturity: 5 to 10 years (grace: 2-4 years) Repayment: schedule based on cash flow forecasts Rates: - Belgian Franc denomirated loans: fixed market rate (revised every fifth year) - other denominations: fixed or floating market rates - political and transfer risk premium: 1% - interest rates on convertible loans or bonds may be reduced by 0.25% to 1%. Collateral: appraised on a case by case basis. Commitment fee: average: 0.75%

SBI (continued)

	Mixed financing	Equity participation and loans
	Investment limits	Total SBI investment in any project: - minimum: FB 10 million - maximum: FB 60 million (i.e. 5%of SBI's share capital)
	Other	- Indirect financing: loans to (usually Belgian) investors to finance their equity participation in a foreign venture. - extension of guarantees - Leasing or lease-back operations
3.	NON-FINANCIAL SERVICES	- Partner and project idenfication - Co-operation agreements with foreign development finance institutions. - Information and advisory services available to small-and-mediur-scale enterprises.
4.	COMMENTS	SBI gives preference to projects using Belgian equipment, technology or know-how, or providing inputs useful to the Belgian industry.

THE INDUSTRIALIZATION FUND FOR DEVELOPING COUNTRIES (IFU)

Bremerholm 4, DK - 1069
Copenhagen K
P.O. Box 2155, DK - 1016
Copenhagen K

Telephone: (1) 14 25 75
Telefax: (1) 32 25 24
Telex: 15 493
Cable: INVESTFUND

Statute: Fund Capital derives from the Danish government

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1. ELIGIBILITY CRITERIA

Geographical coverage

Independent developing countries in Africa, Asia and Latin America with GNPs per capita of maximum USD 3,000 per year.

Sector/sub-sector coverage

- Agriculture, food and drinks
- Chemical products
- Metal industries and engineering
- Consulting organisations and services
- Stone and building industries
- Wood, furniture and textiles
- Paper and paper products

Industrial partner

Danish technical partner and investor

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2. FINANCING AVAILABLE

Equity

Not to exceed 30% of total share capital, not to exceed the Danish partners' holding.

Termination of participation: when project has reached a certain financial stability (after 8-10 years). IFU shares are offered for sale (joint venture partners are given right of first refusal).

Loans

Currency: Danish Krone (DKK)

Interest rates: related to official Danish discount rate. Fixed for the whole maturity period on the date of approval of the loan.

Maturity: 8 to 10 years with a grace period of up to 4 years.

Repayment: equal semi-annual instalments

Investment limits

Not to exceed 35% of total investment, nor participation of Danish partner.

Guarantees

Commission: 1% per annum

IFU (continued)

3.	NON-FINANCIAL SERVICES	Pre-investment studies: loans of up to 2 years to Danish firms to study project feasibility. Project identification and monitoring.
4.	COMMENTS	Management and training agreement required from technical partners. Financial grants possible for development and transfer of Danish technical/commercial know-how of very special character to companies in developing countries. Funds not tied, not related to purchases of equipment in specific countries, including Denmark.

DEVELOPMENT FINANCE CORPORATIONS

FRANCE

CAISSE CENTRALE DE COOPERATION ECONOMIQUE (CCCE)
8/10 Cite du Retiro,
35/37 rue Boissy d'Anglas,
F-75379 Paris Cedex 08

Telephone (1) 42 06 31 31
Telex: 212 632
Cable: CAISCOOP

Shareholders: French State (100%)

1. ELIGIBILITY CRITERIA

Geographical coverage	Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Ivory Coast, Gabon, Guinea, Madagascar, Mali, Mauritania, Niger, Senegal, Togo, Zaire: Dominique, St. Lucia, St. Vincent & Grenadines Grenada, Guyana, Angola, Cape Verde, Equatorial Guinea, Gambia, Ghana, Guinea Bissau, Liberia, Mauritius, Mozambique, Sao Tome & Principe, Seychelles, Sierra Leone, Somalia: Algeria, Morocco, Tunisia:
Sector/sub-sector coverage	Priority is given to productive sector, with emphasis on agro-industry, agriculture and fishing, electricity and transport. Use of local raw materials. Favours projects with technology transfer.
Industrial partner	French technical partner
Other	Agreement of the host government is required Project must be financially and technically viable: Project must be in conformity with beneficiary country's development plan: Equipment supplies from France, Franc area or beneficiary country.

2. FINANCING AVAILABLE

Equity	Minority participation; temporary, Medium sized projects.
Loans	Currency: Lending in French francs; reimbursement in FF.
First window	- ordinary concessionary loans. Average 3 to 5% interest rate over 10 to 20 years, with 5-7 years grace.
	- loans with special condtions. 1.5% over 10 years, 2% afterwards: maximum 30 years with 10 years grace

CCCE (continued)

	Second window	- floating market rate loans
	Investment limits	Variable, depending on project
3.	NON-FINANCIAL SERVICES	- Project identification and preparation - Occasionally, provisionof technical assistance - Training in France of senior management staff of public and semi-public enterprises from eligible developing countries
4.	COMMENTS	In most cases loans must be guaranteed by the beneficiary State. CCCE has recently been expanding direct lending to private sector, through either private banks or companies. It emphasizes its role in rehabilitation and restructuring of private and public sector enterprises. For financing of private sector projects, PROPARCO, a whole subsidiary of CCCE, has been created in 1977 (see separate fact sheet).

SOCIETE DE PROMOTION ET DE PARTICIPATION POUR LA COOPERATION ECONOMIQUE (PROPARCO),

5 Cite du Retiro,
35/37 rue Boissy d'Anglas,
F-75379 Paris Cedex 08

Telephone: (1) 42. 06.31.31
Telex: 212 632
Cable: CAISCOP

Shareholders: CCCE (100%)

1. ELIGIBILITY CRITERIA

Geographical coverage	Benin, Burkina Faso, Burundi, Cameroon Central African Republic, Chad, Congo, Ivory Coast, Gabon, Guinea, Madagascar, Mali,Mauritania, Niger, Senegal, Togo, Zaire: Dominique, St. Lucia, St. Vincent & Grenadines, Grenada, Guyana, Angola, Cape Verde, Equatorial Guinea, Gambia, Ghana, Guinea Bissau, Liberia, Mauritius, Mozambique, Sao Tome & Principe, Seychelle Sierra Leone, Somalia: Algeria, Morocco, Tunisia:
Sector/sub-sector coverage	All productive sectors, but priority to export oriented sectors or sectors with high value added, mainly agro-industry, metal industry, services and hotels.
Industrial partner	French technical partner and French investor are generally required.
Other	Project must be feasible from an econoric point of view. Project must be in conformity with beneficiary country's general policy.

2. FINANCING AVAILABLE

Equity or Convertible Bond	Participation in medium-sized enterprises. Temporary and minority.
Loans	Loans are provided by the CCCE if necessary and can also be supported by PROPARCO (shareholders loans).
Investment limits	5 to 20% of capital according to size of project, bu never more than FF 3 million.
Other	PROPARCO can facilitate access to CCCE financing as well as to other sources of financing from French and African commercial banks.

PROPARCO (continued)

3.	NON-FINANCIAL SERVICES	- improving feasibility studies - analyzing and measuring the different project risks - formulating sound and operational joint venture agreements.

DEUTSCHE FINANZIERUNGSGESELLSCHAFT FUR BETEILIGUNGEN
IN ENTZICKLUNGSLANDERN Gmbh (DEG)
Belvederestrasse 40,
Postfach 45 03 40,
D - 5000 Koln 41
(Mungersdorf)

Telephone: (0221) 49 861
Telex: 8 881 949/8 883 470
Telefax: (0221) 49 86 290
Cable: DEUTSCHGES KOLN

Shareholders: Federal Republic of Germany (100%)

1. ELIGIBILITY CRITERIA

Geographical coverage	All developing countries
Sector/sub-sector coverage	No restrictions. Public/private
Industrial partner	- German companies as technical and financial joint venture partners. - Companies from other EEC countries if only way of implementing project.
Other	Technical partners should take significant equity participation, provide know-how, offer reliable technologies and competitive advantages supply qualified personnel and have adequate planning and supervision capacities.

2. FINANCING AVAILABLE

Equity: Minority only. Generally, maximum 15 years; in due course, sale at the full asset value to nationals.

Loans: Currency: DM only

1. Basic Programme

Interest rates: adjusted to market rates for comparable loans, taking into account refinancing as well as foreign exchange provisions and tax incidence in the country of investment.

Maturity: up to 12 years with a grace period of up to 4 years, depending on sector/country.

Commitment fees: 1.5% per annum on the loan amount not disbursed.

Collateral:
- bank guarantee (local or regional bank)
- first mortgage on physical assets

DEG (continued)

	2. Programme for medium-sized enterprises (with turnover of German partner of up to DM 300 million) Interest rates: basic DEG rates reduced by up to 1.5% per annum. Maturity: up to 12 years with a grace period of up to 3 years. Collateral: not needed. 3. Programme for promotion of handicraft and small industry (with a turnover of German partner of up to DM 10 million & up to 50 employees) Interest rates: basic DEG rates reduced by at least 1.5% per annum. Maturity: up to 12 years with a grace period of up to 3 years. Investment limits: up to DM 300 000. Presence of local partner is not a condition. financial participation of industrial partner is not always necessary. Collateral: not needed
Investment limits	General business guidelines. Generally minimum DM 300 000
3. COMMENTS	- Projects must contribute to country's economic development.

DEVELOPMENT FINANCE CORPORATIONS

GERMANY

KREDITANSTALT FUR WIEDERAUFBAU (KfW)
Palmengartenstrasse 5-9,
Postfach 11 11 41,
D 6000 Frankfurt/Main 11

Telephone: (069) 7431-0
Telex: 41 13 52
Cable: KREDITANSTALT

Shareholders: Federal Government of Germany (80%)
Lander (Federal States) (20%)

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1. ELIGIBILITY CRITERIA (referring to loans/grants under capital aid)

Geographical coverage	More than 90 developing countries have received capital aid.
Sector/sub-sector coverage	Emphasis is placed on: agriculture, economic and social infrastructure, industry.

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2. FINANCING AVAILABLE (referring to loans/grants under capital aid)

Equity	No
Loans	Currency: Deutsche Mark (DM) Interest Rates: for loans under capital aid: 0.75% to 4.5%

Special Programmes:

1. Technology Programme: under this programme, small and medium-sized German companies are given loans on very favourable terms and conditions for the application of new technologies in joint ventures with partners in developing countries. New technologies means production processes and products which so far have not been introduced or manufactured in the developing country.

   Projects must contribute to development of country. Loans of up to 50% of financing of German companies.

   Amount: up to DM 2 500 000

   Interest rates: 1% p.a. during grace period: 2.5% following years.

   Maturity: up to 15 years with a 5 year grace.

   Collateral: security is not normally required for the loans.

KfW (continued)

	Loan repayment: may be renounced under special circumstances. For additional necessary investigations a preparatory loan with even more favourable conditions can be granted.
	2. Subsidiary Programme (for the establishment and expansion of German enterprises in developing countries). Loans granted to small and medium German enterprises for - direct investment in specific project - financing of pre-investment studies Amount: up to DM 2 500 000 Interest rates: 2.5% to 3.5% Maturity: up to 15 years with 5 years grace. Collateral: in principle, by pledge or mortgage: exceptionally other normal banking securities are accepted.
Non-reimbursable grants	(for Least Developed Countries)
Other	- As a rule contracts to be financed from capital aid are subject to public bidding. In order to ensure that the utilization of funds is consonant with the aims of German development policy the principles of international competition are adhered to. The Federal Government can decide that the supplies and services are tied to German firms. - Application for capital aid must be submitted by the developing countries' governments to Federal government which transmits to KfW.
3. NON-FINANCIAL SERVICES	Project-orientated manpower and technical assistance are made available.

NETHERLANDS FINANCE COMPANY FOR DEVELOPING COUNTRIES (FMO) NETHERLANDS

Nassaulaan 25,
POB 85899,
8508 CN The Hague,
Netherlands

Telephone: (070) 61 42 01
Telex: 33042 nefmo nl

Shareholders: State of the Netherlands: 51%
140 private Dutch shareholders: 49%

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1. ELIGIBILITY CRITERIA

Geographical coverage	All developing countries (some countries may not be eligible for practical reasons or for reasons that have to do with the Dutch Government's policy on development and co-operation).
Sector/sub-sector coverage	All sector except purely trading activities or investments which are prirarily of an infrastructural nature.
Project sponsor	Preference is given to local sponsors with a good track record an making a significant financial commitment.
Industrial partner	Substantial interest in the investment.
Other	Project should be viable with high development value.

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2. FINANCING AVAILABLE

Equity	Yes
Loans	Currency: Dutch guilders (Hfl) Terms and conditions Interest: rates must allow a suitable margin above the rate of interest FMO has to pay for funds raised on the capital market. Maturity: normally 5 to 15 years Collateral: adequate security needs to be provided One-time upfront loan fee: 1.5%

In exceptional circumstances, financial aid on concessionary terms can be made avaiable, i.e. loans on more favourable terms than those on the capital markets or subsidies for technical assistance can be provided for the purpose of ensuring know-how transfer, management assistance and training of local personnel.

FMO (continued)

Investment limits	- Equity capital provided should preferably not exceed 25% of total equity - Total financial interest: minimum Hfl 500 000 and more than 10% of total: maximum Hfl 10 to 20 million and less than 50% of total.
3. NON-FINANCIAL SERVICES	- Feasibility studies: contribution of up to 50% of study costs is possible under certain conditions. - FMO can assist projects in identifying management staff.
4. COMMENTS	- No obligation to spend funds provided in the Netherlands - Loans and equity participation only as supplementary financing to normal sources of investment or loan capital. - Shares paid up in local currency: grants either in Dutch guilders or local currency.

DEVELOPMENT FINANCE CORPORATIONS

UNITED KINGDOM

COMMONWEALTH DEVELOPMENT CORPORATION (CDC)

33 Hill Street,
London W1A 3AR
United Kingdom

Telephone: (1) 629 84 84
Telex: 21431 - 25849
Telefax: (1) 493 80 27

Statute U.K. Statutory Corporation

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1. ELIGIBILITY CRITERIA

Geographical coverage	British dependent territories and, with Ministerial approval, any Commonwealth or developing country. Eligible non-Commonwealth countries including Cameroon, Ethiopia, Cote d'Ivoire, Liberia, Rwanda, Sudan and Zaire.
Sector/sub-sector coverage	- Primary production and processing. Renewable natural resources - agriculture, aquaculture, ranching, forestry and minerals together with allied processing plants. - Basic development. Generation of power, water supply and transport. - Industry Factories, industrial and port development, hotels. - Finance companies. Development finance corpanies, mortgage finance compnaies, leasing companies, agricultural credit organisations. Preference is also given to projects which generate foreign exchange, encourage savings and assist credit formation, create local job opportunities, foster management capability and spread technical knowledge, contribute to greater income equality inside the developing countries.
Industrial partner	No specific requirements but CDC is particularly interested in participating in projects with British companies.

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2. FINANCING AVAILABLE

Equity	Yes
Loans	Currency: mainly pound sterling Terms and conditions: Interest rates: equal to, or lower than, World Bank/IFC rates Maturity: 7 to 20 years

CDC (continued)

	Collateral: charge on project assets Guarantee commission Commitment fees: depends on draw-down schedule
Investment limits	Minimum: usually £ 1 million but can be as low as £ 250 000 for private sector projects.
Other	Funds are not normally tied but projects are required to ensure that British suppliers are treated on equal opportunity basis.
3. NON-FINANCIAL SERVICES	CDC may undertake corporate management in the initial project stages in certain areas, especially large-scale agricultural estates, financial development institutions and building societies.

PRIVATE FINANCE INSTITUTIONS

INVESTMENT COMPANIES

AFRICA

EDESA S.A. (Economic Development for Equatorial and Southern Africa)

Kreuzstrasse 26,
P.O. box 490,
8034 Zurich, Switzerland

Telephone: (01) 252 18 95
Telex: 813.315
Telefax: (01) 252.47.75
Cable: EDESA

Shareholders: About 25 banks and industrial groups

1. ELIGIBILITY CRITERIA

Geographical coverage	Independent developing countries and adjacent islands south of the Sahara and north of South Africa.
Sector/sub-sector coverage	Priority is given to productive sectors, no other restrictions.

2. FINANCING AVAILABLE

Equity	Minority share participation.
Loans	Currencies: usually USD, DM, SFR, £ or local currencies in specific cases. Interest: commercial rates Maturity: medium and long term Collateral: loans must be secured by government or local banks Commitment fee: payable on undrawn portion of the loan (on average 1%)
Syndications	EDESA can organize complementary financing for a specific project.
Investment limits	Generally, maximum USD 1 million

3. COMMENTS

Government's agreement is required.
Loans not tied to supply of equipment from any specific country.

SIFIDA INVESTMENT COMPANY (Societe Internationale Financiere pour les Investissements et le Developpement en Afrique)

8c, Avenue de Champel,
P.O. Box 396,
CH 1211 Geneva 12
Switzerland

Telephone: (022) 47 60 00
Telex: 422.047
Telefax: (022) 46.21.61
Cable SIFIDA

Shareholders: 130 major banks and industrial groups: African Development Bank, International Finance Corporation

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1. ELIGIBILITY CRITERIA

Geographical coverage	All independent African developing countries;
Sector/sub-sector coverage	Priority is given to productive sectors, especially in agro-industry, manufacturing, tourism, export oriented projects, using local raw materials. Preference to private sector, but public sector not excluded for viable projects.
Industrial partner	Industrial partner is expected to take meaningful cash equity share in the project and have a proven record of successful management of similar ventures.

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2. FINANCING AVAILABLE

Equity	Minority share participation to supplement loan financing in selected cases. Termination of participation: in due course, participation is expected to be sold to nationals of host country at mutually acceptable terms.
Loans	Currencies: usually USD, DM, FF or ECU; other currencies possible. - Medium or long-term loans Interest rates: either fixed for entire duration of the loan or floating, reviewed every 6 months. Calculated by reference to London inter-bank offered rate (LIBOR). Margin variable depending on project and country risk (usually between 1 and 3%). Duration: 5 to 10 years. Will depend upon cash-flow needs and include a grace period of 1 to 3 years.

SIFIDA (continued)

		Repayment: usually in equal semi-annual instalments. Collateral: depending on nature of project and sponsors, loan must be secured either by prime bank or any other acceptable entity, by government or on the company's assets. (external retention accounts, for instance). Commitment fee: payable on undrawn portion of the loan (on average 1%) - Short-term loans: Up to 5 years, also available. Floating interest basis as above. Collateral by prime bank or government guarantee.
	Syndications	SIFIDA can organize complementary financing for a specific project, using the financial resources of its shareholder banks. Conditions are normally based upon those of the international euro-currency market for the country concerned.
	Investment limits	Maximum 10% of SIFIDA's shareholders' funds (about USD 2.2 million per project): not to exceed 50% of total cost of any one project. Balance of loan requirements can be raised by SIFIDA in cooperation with its shareholders. Minimum: SIFIDA's total investment usually not below USD 300 000 to 500 000 per project.
	Other	Barter, forfaiting, leasing, prefinancing of exports, can be considered.
3.	NON-FINANCIAL SERVICES	Full range of pre-investment, project feasibility and evaluation consultancy services available through SIFIDA Advisory Unit at agreed terms.
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MEASURES TO STRENGTHEN AN ENVIRONMENTALLY SOUND SUSTAINABLE SUPPLY OF TIMBER RESOURCES*

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* This document has not been edited.
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The cause for concern

1. The supply of timber for the secondary wood processing industries is governed by the supply of raw material from the world's forests to the primary forest industries. The current annual removals from the world's forests to satisfy the demand of the world's forest industries amount to somewhat less than an average 0.5 m3 per hectare. Therefore as the World Bank has noted, there is no imminent shortage of industrial wood.

2. This cannot be taken to mean that the supply is assured for all species of importance or interest, or that local supply will be adequate in all regions. The availability of some species will continue to decline, reaching before too long, the point at which they virtually disappear from the timber catalogues. The true Rosewood and Mahogany as well as Afromorsia and Ramin are notable candidates for that list. Overcutting and the clearance of forests for agriculture are solely responsible for this fact. Some regions in which the local wood supply-demand balance is already in deficit, will stay that way. In some the gap will continue to widen, while others will gradually slide into deficit. In a few, the present deficits will be reversed as their plantation and re-growth resources mature.

3. However the recorded removals are only part of the drain from the forests occasioned by industrial wood operations. Each tree felled for its industrial wood value yields logs and pulpwood which, if removed, enter the recorded removals which residual roundwood does not. Nor do logs and pulpwood which, for various reasons, are left in the forest. Yet it is the felled tree which constitutes the real drain, not just the part which is recorded as removed. In the more intensively managed forests the discrepancy may be quite small. In the majority of the world's forests, however, the logging residual component of the drain can be quite substantial, especially in those where there is no market for pulpwood or small or defective logs. The removal statistics for the world as a whole could well understate the drain associated with industrial wood utilisation by 30 to 40%.

4. Taking these considerations into account, the present annual drain, for industrial wood, shows an average of 0.7 m3 per hectare. How this compares with the average growth potential of the forests is hard to say with certainty since such estimates are scarce and fragmentary. Overall however, the average current annual increment, in terms of industrial wood could hardly be less than 2 to 3 m3 per hectare. On that basis the potential supply capacity of sustained yield forest management, left to itself, has plenty in reserve to meet rising demands for industrial wood.

5. However, this optimism must be tempered by the effects of acid rain in the temperate regions and by losses due to a number of factors resulting from the absence of effective forest management in the tropical regions. While strong environmental measures have been initiated in some countries to reduce acid rain these measures have come too late to reverse some of the damage. While loggers in the industrialized countries may be able to count on support from environmentalists to combat acid rain, they are certainly at odds concerning the amount of forest land which should be withdrawn from logging to protect sensitive environmental values. There is significant pressure as well as for withdrawal of portions of the tropical rainforest from logging in order to reduce the rate at which the genetic heritage is being lost and to protect other values.

6. However the main threats to the tropical forest are not from industrial logging but from slash and burn agriculture and unmanaged fuelwood gathering. Indeed while industrial logging can contribute to the destruction of the tropical forest if not undertaken under a forest management plan, its effects have the potential of having exactly the opposite effect by helping to bring a larger portion of the tropical forest under management. Bringing forest land under management is critical. First this can ensure that conversion of forest lands to other uses does not occur by accident, but through controlled and regulated processes which reflect the true economic and social value of these lands as forest versus their value in other uses. Second, harvest and above all fuelwood harvesting, must be carried out according to a plan. The real allies of the environmentalist whether they understand it or not are those industrial timber producers who have a commitment to forest management. This is not to say that all environmental and logging interests are identical, but there is enough common ground to make it very much in the interest of both groups to co-operate, as they indeed have in many fora. With regard to the preservation of the tropical rain forest the International Tropical Timber Organization (ITTO) is one forum where environmentalists and the forest industries have found considerable common ground.

7. While industrial forest practices can be improved without greatly increasing the cost of logs, it should be emphasized that the real threats to the tropical forests do not come from this quarter. One of the greatest is the haphazard conversion of forest lands to temporary agriculture. In only one or two years such lands are not longer suitable for agriculture and are abandoned. These lands, stripped of their productivity through leaching and erosion, all too often do not revert to forest lands, but become wastelands. Erosion can ruin productive fisheries, flood control, irrigation and hydro-electric facilities. The other main factor accounting for deforestation is over-harvesting of wood for fuel. The 1989 FAO Yearbook of Forest Products

puts harvesting of fuelwood (including charcoal) at nearly fifty percent more than that of total saw and veneer logs. But volume alone is not a very accurate indicator of the problem. Most fuelwood harvesting takes place in a totally unmanaged environment. Further the fact that the trees taken are of a small diameter means that a lot more trees are felled to generate the same volume.

The extent of the timber production resource base

8. The total area of the world's forest resources is approximately 3,500 to 4,300 million hectares, depending on the definition favoured and, to some extent, the purpose which the estimate is intended to serve. The lower level is that given in the latest available FAO (1988) assessment and is taken as the basis for the estimates in this review. This area represents roughly 27% of the land surface of the planet, a proportion which is fairly close to that which the classical European foresters used to recommend as the minimum area of forest required for national economic and social well being. To the extent that it is a sensible criterion the world is still fairly well endowed with forests.

9. At present around 1700 million m3 of industrial roundwood are harvested annually from this forest resource, the rate having risen steadily at around 1.5% annually over the last 10 years. The two sets of figures - area of the resource and the annual demand - give the earlier quoted drain of less than 0.5 m3 per hectare.

10. It is, however, misleading to relate the rate of drain to the total area on that basis. Three qualifications at least are necessary. The first has already been referred to: removals understate the drain. To correct this figure the present annual drain should be set around 2200 to 2400 million m3. Secondly, around 200 million hectares is under some form of protected reservation and thus not available for timber production at all. Finally, much of the remainder, (around 800 to 1000 million hectares) must be ruled out for use as industrial timber production because the forest is too stunted or low yielding or the terrain is too difficult for harvesting operations.

11. Having deducted these areas from the total, the area of forest from which the industrial wood requirements can be drawn is reduced to around 2300 million hectares. This situation is summarised in Table 1.

12. The average intensity of harvesting for industrial wood therefore is closer to 1.0 m3 per hectare for the forests from which it is actually drawn. But even at this higher level of usage industrial wood requirements do not really put any strain on the present sustainable capacity of the forests available for timber production.

The changing resource base

13. Several factors are combining to change the area of the world's wood resource base. Perhaps the most obvious is that the total area is steadily being reduced by clearance each year of substantial areas, probably amounting between 16 and 20 million hectares, mainly for agriculture but also significantly for infrastructure. The important factor about this rate of loss is that it is more likely to rise than fall until the present economic conditions in most of the developing world are reversed. Most of the forest lost through these causes is tropical, but some clearing of temperate forests for agriculture continues. Not all clearance, however, takes place at the expense of forests which could otherwise contribute to the sustainable wood supply. Some occurs in the category deducted earlier as unsuitable for timber production and some is even in the theoretically totally protected reserves. Hence the annual net loss of timber production might be no more than 80 to 85% of the total being cleared each year, i.e., say 12 to 16 million hectares.

14. The second factor is that the area of forest is, at the same time, increasing as abandoned farmland reverts to forest, either through the slow process of natural succession or by accelerated programmes of plantation establishment. Most of this addition comes from agricultural adjustment, land rehabilitation and industrial forestry programmes in the temperate forests of the developed countries. Some of the tropical forest clearances also fall into this reforestation category, as agricultural developments on unsuitable land fail or cleared land reverts to forest fallow. Unlike the temperate areas, however, it would be hazardous to count on these areas remaining permanently as forest since, under present conditions the attempts are almost certain to be repeated.

15. One result of this reforestation is that forest plantations and some agricultural tree crop plantations are starting to become a significant component of the world's sustainable wood resource. At present they account for rather less than 0.5% of the world's forest area. By that measure they are almost negligible and at the present rate of expansion, 5 to 6 million hectares a year, (Sedjo, 1989) it will be a long time before they amount to much in that respect. However, from the point of view of industrial wood supply, their area is no measure of their eventual impact. Plantations are on average, at least 5 times and often 10 to 20 times more productive than natural forests. Hence, even as a relatively small proportion by area their much higher productivity will bring a noticeable increase in the average annual productivity of total forest resources. This effect on average increment, combined with increasingly intensive management in natural forests, means that a rising average sustainable annual growth rate per hectare over the world's timber production forests is a third factor to be taken into account.

16. An estimate of the net effect of these forces is summarised in Table 2. The outlook presented there is derived from the present extent of the resource base for sustained timber supplies and how its sustainable wood supply capacity would change under the stated assumptions.

17. For how long this sustainable capacity will be sufficient to supply the wood-based industries depends on the evolution of demand for wood products.

Demand outlooks for industrial roundwood

18. At their present extent, it can be seen that the forests available for industrial timber production would still have a very considerable margin over demand for timber and wood products. Demand in the future may or may not continue to grow at the same rate as it has in the recent past. Projections to the year 2000 which were prepared by FAO in 1986, are currently being revised. In the fourth European Timber Trends Study (ECE/FAO 1986) forecasts were made for Europe for the years 2000 and 2020. An earlier FAO study based on industrial and expert opinions also made forecasts from 1980 to 2000.

19. As the compilation from these outlooks in Table 3 indicates, there is no danger of supply, overall, failing to match demand for industrial wood by the end of this century. Even if demand continued to grow at 1.5 to 2% annually after 2000 it would be well into the third decade of the next century before exceeding an average annual growth rate of 3 m3 per hectare.

20. This is based on the present area of timber production forest. By the middle of the next century, well over one-third of present forest resources will have been eliminated by clearing for agriculture. The gain in average productivity will be unable to match the rate of loss in area unless the plantation resource over the same period expands rapidly enough to fill the gap. The present rate of industrial plantation development would be enough as, in terms of wood production potential, plantations are replacing the forests lost by a factor of 3 to 5. For industrial roundwood raw material supply, the point of global over-cutting is still a long way off provided there is no significant decline in the rate of industrial plantation development or a sharp increase in demand.

The environmentally sound sustainable supply

21. In the light of an environmentally sound sustainable supply, however, the above outlook could be too optimistic. Too few of the world's tropical forests are under management and even fewer are managed on a substained yield basis.

22. The term "environmentally sound" is not very precise. The words used to mean more, but public concern about environmental issues has increased to such an extent that nearly all public information specialists urge their clients to call their policies environmentally sound. Nonetheless, if the rhetoric has lost some of its meaning the underlying concerns are quite real and as important as ever. The issues take on somewhat different meanings in the context of international versus strictly national constituencies. At the national level, the issues tend to concern local effects. These would include preservation of wildlife habitat, recreational and cultural use of forests, watershed protection, the preservation of aesthetic values, maintenance of soil productivity and the productivity of the forest, and the preservation of the physical heritage. At the international level the issues are entirely different. They mainly come down to preserving the global genetic heritage and possible effects on the atmosphere and climate. There is considerable support for the idea that if global values are at stake then there ought to be a global sharing of the burden of costs of achieving these objectives.

23. From the national perspective these issues are easier to deal with since the cause-effect relationships are better understood. But even from the national perspective there are a wide variety of interests and opinions concerning the appropriate mix of environmental versus other interests. The issues are perhaps more difficult to assess from the international perspective. Probably the recent ITTO decision to put the production of tropic timber on a sustained yield basis by the year 2000 represents a good middle ground. It gradually puts the brakes on the erosion of the tropical forest while it protects producers by giving them time to make the necessary adjustments. It must be emphasized, however, that the term "sustained yield" is also not very precise. It means that the potential harvest per time period (eg. harvest per decade) and area does not fall over time but it is not a species specific concept. One of the important effects of the ITTO decision is that it will mean more extensive forest planning and management. Without them, national forest use objectives cannot even be established, much less achieved.

24. Two effects must be taken into account. First, the standards for certain aspects of environmentally sound management can only be met under totally protected reservation. The area at present withheld from timber production on this account will probably be found to be too small. The minimum requirement for tropical forests is, for instance, accepted as 8-10%, by conservation organizations. The demand for such reservations in the forests of developed countries could, under present circumstances, rise to a total of 20-25%. Another 300 to 400 million hectares could therefore easily be withdrawn for these purposes.

25. Second, the restrictions on operations to protect watercourses, wildlife corridors and flora and faunal habitats in order to meet the standards of environmentally sound management will reduce the effective area of the forests available for timber production. The general consensus of studies in that field suggests that the areas which should be protected could amount to another 25-30%. Average annual productivity per hectare will therefore be at least that much lower than calculations based on the nominal area of the timber production resource.

26. The net effect of these second generation factors would be to reduce the effective area of the world's timber production resource from which future supplies can be safely anticipated to around 1400 to 1700 million hectares, considerably less than half the present total forest area.

27. The global adequacy of supply suggested by the earlier calculations is evidently nowhere as well assured as it would be without these further extensions of the environmental constraints. All the same, the situation is still not desperate. From the summary in Table 4 it can be seen that even by the year 2040 there is still a safety margin of around 25%. Hence it is an outlook which calls for action but not panic. There is still enough time to mount programmes of plantation development to fill the gap.

28. But future supplies do depend heavily on the plantation resources. The environmentally sound sustainable supply from the natural forests available for industrial wood production could have fallen below the demand by 2020. So the surety really depends on there being a well-established plantation resource capable of taking over the load with no slackening of the rate of new planting below the 5 to 6 million hectares per year on which the outlook is predicted. At this point a third possible impact of the requirement for environmentally sound resource management has to be taken into account. This is the growing tendency for limits, allegedly to safeguard the environment, to be placed on the extent, location, and nature of plantation programmes. If these restrictions come to be widely applied then it may turn out that neither the area nor the productivity of the plantation resource can counteract the decline in sustainable supply arising from the reduced area of natural forests available to the timber industries.

29. While on balance the outlook for industrial wood through the next century indicates availability of adequate supplies, it gives few details. Short-run supply-demand imbalances are as likely to arise from time-to-time in the future as they have in the past and there will be regional shortages and surpluses. There will also be short-run market imbalances for some species.

Speciality timbers

30. The declining supply of some of the better known speciality and fine timbers has been mentioned earlier. Secondary wood processing industries which are critically dependent on continuity of supplies of these timbers could therefore be in jeopardy, by the year 2000. In fact, the effects are already evident with rising prices and declining quality of the available supplies. The phenomenon is, however, nothing new so the measures to deal with it are well known and in place. One measure is the substitution of timbers by similar properties, a process by which, in the tropical forests especially, a number of well-regarded species graduated from the so-called secondary species class.

31. Another measure is the establishment of new and replacement sources of supply in plantations. Teak is possibly the outstanding example with extensive and widespread areas already established and more than sufficient to meet world demand, in volumetric terms. There is less assurance about the supply in terms of quality unless longer rotation is applied, as has been shown in Indonesia.

32. True mahogany is another example of successful ensurance of a replacement supply although silvicultural difficulties have, so far, been more limiting for both the range and extent of its expansion. Again the quality of future supplies may be less certain than the volume but an early start in some areas may cushion the supply.

33. In contrast, the plantation solution to future supply with some other species in this category has not, as yet, been tried. For some, such as Ramin, time has perhaps run out and with its slow growth in the natural forests, the past and still current over-cutting, leaves substitution say with Rubberwood or Gmelina as the only viable alternative.

34. A third measure, also already standard practice, is to be more sparing in the use of the supplies still available. Market forces tend to drive secondary processing in this direction rather more than they have yet done with forest practices in the tropics. However it can hardly be long before

the economic messages are reflected in stumpages and sustained supply controls, just as they have been with speciality timbers in temperate forestry. The economic exigencies would then spur technological measures (e.g. veneer slicing, drying, figure matching) to make the best technical as well as economic use of the high value resource.

The regional outlooks

35. This global view of overall adequacy of future supplies does not apply uniformly at the regional level. Some parts of the world have had deficits for many years. In some instances the shortages arise from natural causes but for the most part they have been created by past mismanagement and in many places are being aggravated by continued mismanagement. On the whole, however, this is not a major problem. With industrial wood, local and regional deficits can be met by imports of raw materials, semi-processed wood or the finished article. In fact the ease with which imports can displace local products in their home markets is a constant complaint of timber growers and primary processors.

36. The simple expedients of international trade theory and practice are less applicable with non-industrial wood. Rarely can the value of the products or the incomes of those most in need bear the costs of long distance transport. This, in turn, can affect the industrial wood supply since needs for wood fuel and similar subsistence uses which must be satisfied as a matter of survival will over-ride any legal or economic commitments to wood for industry.

37. The broad regional variations from the global situation are reflected in the attached tables. Perhaps the most important and disturbing fact is the declining significance of the tropical regions. The distribution and the rate of decline would no doubt vary between the tropical regions. Africa, for instance, could cease to register in the commodity timber trade virtually through lack of resources alone. Asia and Latin America, while still having some natural forests and significant plantation resources may have to compete with the highly productive and strategically located industrial plantations of the developed countries. The more promising future in timber production for the tropical forests lies, it would seem, with the speciality and fine tropical hardwoods. The shortage of supply of these is imminent and certain.

The time factor

38. The fact that it is going to take time for supply measures to contribute to the future supply/demand balance has two important implications. The first is that anything which can be done to increase productivity in the forest, natural as well as plantation, and to shorten rotation has to be done together with the plantation replacement measures. All aspects of more intensive management such as tree breeding, fertilization, accelerated thinning regimes,

and soil cultivation will have a place. The risk, referred to earlier, that plantation development may not be allowed to proceed solely in the interests of industrial timber production, lends a degree of urgency to the wide scale adoption of these necessarily long term silvicultural measures.

39. The second is that measures on the industry side will have to be adopted as insurance against any shortfall in the plantation supply.

40. Not all of the measures, however, which seem, at first sight, to be available on the industry side are practicable. With some, such as increased intensity of utilisation of the wood from felled trees, the obstacles are economic. The lower quality logs and smallwood which are left in the forest are, as a rule, more expensive to handle or process than the timber now taken. Eventually, declining supplies and technological advances in logging should create the conditions to bring them within economic range. Until that happens there are some measures that industry can undertake to accelerate the transition.

41. Part of the economic problem with the smallwood residues is an artifact of the logging systems used for the main scale operations. Designed for bulk handling of big pieces they simply cannot handle the residual material at a reasonable cost. Timber sales procedures and property rights often prevent other operators who have appropriate gear from coming in either in association or subsequently. Sometimes, admittedly, the appropriate equipment or system has not yet been adapted to logging but that only confirms that the problem is as much institutional and organisational as it is economic. To that extent this is something which is in the industries' own hands and does not, in principle, have to wait for more favourable economic conditions.

42. For certain other measures, the obstacles are mainly technical so that industry-based measures can be more immediately effective. High silica content, chemical constituents in the bark or the wood or irritants in dust from machining, limit the extent to which some species can be used at all, while the potential uses for others are limited by difficulties in drying, machining or behaviour in place. In such cases more resources into industrial research and development might overcome the problems and thus add to the usable resource base.

43. How well such measures would qualify as meeting the standards of environmentally sound sustainability is, to a degree, questionable. Residual roundwood often provides habitats for fauna and floral elements of the natural eco-system as well as playing an important role in nutrient recycling. Its removal to augment the supply of industrial wood supply would, therefore, not necessarily be as neutral as environmental soundness would require.

44. The increased use of commercially less-accepted species (CLAS), with the technical limits mentioned above, is also questioned. The problem of these lesser-used or lesser-known or secondary species is usually raised in reference to the tropical forests. It is, of course, not confined to them. Most types of temperate forest have species which could, if they were used, add to the sustainable supply. But in the tropical forests, the majority of the species are in this category and often a very substantial proportion, up to 60% in some forest types, of the standing wood volume. With this addition the tropical forests could have at least twice the potential allowed for in the calculations underlying the supply potential shortage of the mid 21st century.

45. However, measures to increase the utilisation of the secondary species of the tropical forests could not qualify as environmentally-sound management. The essential feature of environmentally sound timber harvesting and management operations is that they should have a low and temporary impact on the forest eco-system. The fewer trees removed per hectare, the easier it is for the operation to be conducted as a low impact one. But the increased utilisation of the secondary species implies removing more trees per hectare unless they are to be used instead of the present preferred species. The first approach breaches the low impact requirement of soundness; the second would make no addition to the wood supply.

Measures in processing and use

46. Industrial measures based on improvements and substitutions in processing and use of the wood available from an environmentally sound sustainable supply seem to be more promising supplements to the forestry measures. They do not the risk so much of the emergence of unsuspected adverse environmental consequences which is always a feature of the complex forest eco-systems. This does not mean that they are fully predictable in that respect but they are more amenable to corrective measures when the unexpected does occur.

47. Wood saving measures are of three general classes. One includes those which increase the yield of finished product from a given quantity of wood raw material. High yield pulping technology is typical of this approach.

48. A second class of measure is that based on the use of waste material from the operations in the forest and in manufacturing. The various types of re-constituted wood panels, the development into wider and expanded use of laminated beams and members and the continuing addition of new products in these fields, such as scrimber and valwood, have already shown that the net gains which can be made are quite considerable.

49. The measures which depend on the utilization of forest residues are not, however, necessarily consistent with increasing the environmentally sound sustainable supply or its efficient use. To the extent that the processes depend on increased use of forest residues they could run into the problems mentioned earlier. Removing the smallwood residues which represent the upper stemwood and branches would reduce the nutrient return to the eco-system. If this additional loss of nutrients were of sufficient magnitude to reduce productivity in subsequent rotations, as it could be with fast growing plantations, (Keeves, 1966) then any increase in the present wood supply could be at the expense of future wood supplies.

50. The main weight of these measures would therefore, have to rest on greater recovery of the residues at the manufacturing and user end. The net effect, it must be assumed will be considerably less in terms of volume and appreciably higher in terms of cost than the experience to date with the use of wood residues might indicate.

51. One important area of increased efficiency in wood use lies in reducing waste. While waste materials can be recycled as fuel or fibre, such recycling is never likely to reach 100 percent of all waste material generated. Nor is fuel or particle board as valuable as if used as a solid wood product. Thinner kerfs and smoother cut more precise cutting are two areas where gains can be made. Other important wood savings can be made through more efficient cutting designs. There are experienced and talented craftsmen who look at a project and intuitively cut lengths and panel pieces so as to waste very little of the wood stock, and for a process that is repetitive, over the long-term even less capable persons can adjust cutting so that wastes are reduced to a minimum. But this is not the rule and much sawnwood and panel stock are lost through wasteful cutting practices. There are a few basic rules that help conserve materials and these should be made a part of wood processing education and training programmes. Management must also try to instil wood-waste consciousness in employees, particular in applications like construction where ad hoc cutting decisions are made routinely by craft workers. Micro-computer-based optimal cutting algorithms can be used to lay out cuts in a way that minimizes the amount of stock lost to scrap. These systems are so cheap and easy to use that they can be used even in situations where the cuts will only be made once, but where the same stock sizes are to be cut repetitively to the same component sizes the use of computer optimized cutting patterns is a must.

52. Another area of potential wood saving lies in improving the durability of wood. If, for example, through proper design and proper wood preservation techniques, the lifetime of a wooden bridge is doubled, that represents a 50 percent saving in wood materials.

53. More weight will, therefore, have to be placed on the third set of measures, which can be broadly described as re-cycling. The main target of recycling has been in paper. Waste paper could be used to a greater extent than at present to replace virgin pulp, but there are technical limits as to how far the substitution can be taken without marked decline in quality and increase in cost. As a partial solution to the supply problem, waste paper recycling is a measure which should be actively promoted by forest industries as a whole and research into extending its potential should be an industry-wide co-operative venture.

54. Recycling of previously-used solid wood products can also offer potential savings. Wooden packaging products such as cases and pallets are widely re-used many times but their ultimate salvage after they can no longer be re-used for say fibre-use is a largely unexploited field. With roughly 5% of the world's timber consumption being in this form there is some potential for a substantial addition to the net raw material supply. However, a much greater potential may lie in the salvage of timber from demolition of old buildings. With over 50% of the world's roundwood consumption going into construction which then involves a substantial amount of replacement, the theoretical potential to salvage much more of the old solid timber is quite high. Even if its nature and condition precluded re-use in the original form it could supplement the supply of raw material for fibre-based industries. A research and development programme to that end would be a good investment for the industry.

Conclusions

55. While 21st-century wood supplies can be assured if steps are taken to increase plantations and reduce the rate of deforestation, the situation is far from hopeless. In the industrialized countries, steps must be taken in the near future to control environmental threats to the forest such as acid rain. In developing countries the loss of forest to haphazard slash-and-burn agriculture and uncontrolled exploitation for fuelwood will continue but there is hope for some reduction in the rate at which the forest is disappearing. As industrial logging in the tropical-timber-producing countries is put on a sustained yield basis it can be expected that a larger and larger portion of the tropical forest will come under management, which could have a positive effect in controlling deforestation. On the other hand there is a need to safeguard the world's genetic heritage by protection of some portion of the tropical forest in its natural state. There is also a need to ensure that all the potential services of the existing forest are exploited. These include not just logging but also watershed protection, protection of soil productivity, recreational and cultural uses, the provision of wildlife habitat etc. Thus there will be restrictions on logging practices and for some areas the total withdrawal of lands from logging.

56. The above restrictions on logging will have an impact on the potential wood supply and so underline the need to carry through with the expansion of industrial plantations and with reforestation projects. Gains can also be made from the development of measures to increase the efficiency with which wood is used and to improve wood recycling efforts.

57. Most of the impetus for these measures can come from market forces and so do not require explicit governmental measures except to provide the proper macro-economic framework. There are, however, areas where government has an important role to play. The legal and administrative framework must be developed to allow forest plans to be devised and implemented. This means that uncontrolled slash-and-burn agriculture must be halted and cutting trees for fuel brought under control.

58. Governments can also contribute through assisting in the provision of training facilities and the promotion of industrial research, development and information centres. These facilities can probably be best financed through a combination of government-funded financed in part through direct user fees.

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TABLE 1

Estimated Area of World Forest Resource
Available for Industrial Wood Production in 1990
ha x 10^6

REGION	TOTAL	TOTALLY PROTECTED	UNSUITABLE	NET AVAILABLE FOR INDUSTRIAL TIMBER PRODUCTION
Tropical forest				
Africa	684	51	319	314
Asia	272	19	83	170
Latin America	740	16	179	545
Oceania	38	2	27	9
Sub-total	1734	88	608	1038
Temperate forest				
Africa	1			1
Asia	183	8	19	156
Europe	137	3	9	125
Latin America	51	3	9	39
North America	485	38	44	403
Oceania	47	10	1	36
U.S.S.R.	740	20	273	447
Sub-total	1644	82	355	1207
TOTAL	3378	170	963	2245

Source: F.A.O. 1988
Adjusted for estimated changes since 1980.

TABLE 2

Estimated Environmentally Sound Sustainable Supply Per Annum of Industrial Timber to Year 2040

volumes $m^3 \times 10^6$ R.W.E., areas ha $\times 10^6$ - rounded to nearest 10×10^6

AREA AVAILABLE FOR TIMBER PRODUCTION	YEAR 1990	2000	2010	2020	2030	2040
Tropical Forest						
Natural - Nominal area	1040	900	740	580	450	330
- Area adjusted for reserves	1030	850	630	440	340	250
Plantation	10	30	40	60	70	90
Temperate Forest						
Natural - Nominal area	1230	1180	1090	980	880	780
- Area adjusted for reserves	1050	940	820	740	660	590
Plantation	80	120	170	220	270	290
SUSTAINABLE SUPPLY						
Tropical Forest						
Natural at:						
1.0 m3/ha	1030	850	630	440	340	250
1.5 m3/ha	1540	1270	940	660	510	370
2.0 m3/ha	2060	1700	1260	880	680	500
Plantation at:						
8.0 m3/ha	80	240	320	480	560	720
12.0 m3/ha	120	360	480	720	840	1080
15.0 m3/ha	150	450	600	900	1050	1350
Temperate Forest						
Natural at:						
3.0 m3/ha	3150	2820	2460	2220	1980	1770
4.0 m3/ha	4200	3760	3280	2960	2640	2360
4.5 m3/ha	4720	4230	3690	3300	2970	2650
Plantation at:						
8.0 m3/ha	640	960	1360	1760	2160	2320
12.0 m3/ha	960	1440	2040	2640	3240	3480
15.0 m3/ha	1200	1800	2550	3330	4050	4350
Total Tropical	1110-2210	1090-2150	950-1860	920-1780	900-1730	970-1850
Total Temperate	3790-5920	3780-6030	3820-6240	3980-6630	4140-7040	4090-7000
TOTAL ALL	4900-8130	4870-8180	4770-8100	4900-8410	5040-8770	5060-8850
Plantation Supply as % of Total	15-17	25-27	32-39	46-50	54-58	60-64

Note: Adjusted for changes and restrictions as discussed in text.

TABLE 3

Projected Global and Regional Production of Industrial Roundwood to the Year 2040
$m^3 \times 10^6$ R.W.E.

SOURCE OR BASIS	Mean 1986-7	YEAR 1990	2000	2010	2020	2030	2040
Recorded	1604						
F.A.O. 1982		1741	2086				
1986		1414	1811				
1988		1655	2077				
Chase 1986		1397	1706				
Extrapolated at a constant rate of 1.0% p.a.		1650	1826	2017	2228	2461	2719
1.5%		1679	1949	2262	2624	3046	3534
2.0%		1703	2076	2531	3084	3760	4584
Projections by F.A.O. (1988)							
Africa	53	53	64				
Asia	254	333	444				
Europe	298	328	404				
Latin America	104	125	190				
North America	574	529	653				
Oceania	30	20	25				
U.S.S.R.	291	280	318				
Extrapolated at a constant rate of 1.5%							
Africa		55	64	74	86	100	116
Asia		266	308	358	415	482	559
Europe		312	362	420	488	566	657
Latin America		109	127	147	170	198	229
North America		600	697	809	938	1089	1264
Oceania		31	36	42	49	57	66
U.S.S.R.		304	353	410	476	552	641
World		1677	1947	2260	2622	3044	3532
Extrapolated at the annual rate at the average 1976/7 and 1986/7							
Africa		56	67	80	96	114	136
Asia		266	308	358	415	482	559
Europe		310	353	401	457	519	591
Latin America		109	127	147	170	198	229
North America		613	762	947	1178	1464	1820
Oceania		32	38	45	54	65	77
U.S.S.R.		289	284	278	272	267	262
World		1675	1939	2256	2642	3109	3674

TABLE 4

Projected Annual Drain of Industrial Wood from the Global Forest Resource Available for Timber Production Compared with Environmentally Sustainable Supply to the Year 2040

$m^3 \times 10^6$ R.W.E. rounded to nearest 100×10^6

	YEAR					
	1990	2000	2010	2020	2030	2040
Drain	2100- 2300	2300-2700	2600-3300	2900-4000	3300-4900	3500-6000
Env. Sust. Supply from:						
Natural For.	5800- 9600	3700-6000	3100-4900	2700-4200	2300-3700	2000-3200
Plantation	700- 1300	1200-2200	1700-3200	2300-4200	2700-5100	3100-5700
Total Supply	6500-10900	4900-8200	4800-8100	4900-8400	5000-8800	5100-8900
Drain as % of Total Supply	21-32	33-47	41-54	48-59	56-66	67-69
Natural For. Supply	24-36	45-62	67-84	95-107	132-143	175-187

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS CENTRE FOR HUMAN SETTLEMENTS (HABITAT)

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GREATER UTILIZATION, ON A SUSTAINABLE BASIS, OF WOOD INCLUDING COMMERCIALLY LESS-ACCEPTED SPECIES AND PLANTATION SPECIES AS A SOURCE OF INDIGENOUS BUILDING MATERIAL IN HOUSING AND CONSTRUCTION*

Prepared by
the United Nations Centre for Human Settlements (HABITAT)

*This document has not been edited.

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I. The significance of wood, including CLAS and plantation species, for housing and construction in developing countries

1. An important objective of the Second Consultation on the Wood and Wood Products Industry is to promote greater use of wood, particularly CLAS and plantation species, in housing and construction, inter-alia, as a means of improving access of low-income groups to shelter, and thus to better living conditions. Ensuring the availablity of indigenous building materials, that are durable and can be afforded by the low-income groups, is also, a central concern of the Global Shelter Strategy.1/ The Strategy lays special emphasis on the exploitation of local resource endowments, particularly, of renewable resources, by using labour-intensive, optimum-scale that can make full use of local factor inputs and proximate markets.

2. Several building materials have been identified which, if effectively promoted, can significantly ease the current shortage of building materials, notably, fired-clay bricks and tiles, soil blocks, low-strength binders, and timber. Of all the locally available building materials, wood, in particular, the renewable plantation species and the commercially less-accepted species (CLAS), offer many advantages, and if properly managed and exploited, can serve as an abundant source of a locally available building material.

3. The merits of wood, as a building material are, first and foremost, technical. It has high structural resistance and resilience in relation to weight. In addition, wood has excellent thermal efficiency and sound insulation qualities. Processing of wood requires less energy, per unit weight, than other comparable materials. Due to technological innovations, the durability of wood can now be ensured; indeed, low-cost techniques are now widely available to ensure resistance of wood against bio-degradation. Similarly, architectural and design techniques and protective linings now permit adequate resistance of timber constructions against fire much in the same way as competing materials will survive a fire attack.

4. In its natural state, as well as with minimal processing, wood can be used to construct an entire building: both in sub-structure and superstructure, in flooring, walling as well as in roofing. Wood is relatively easy to work with, and secondary processing for basic use as structural or roof-cladding material can be attained with rather rudimentary equipment. Wood can easily lend itself to prefabrication techniques for mass housing. Considerable scope, in fact, exists to speed up construction and to reduce costs by large series of basic components such as door frames, timber posts and beams, purlins and rafters, and components for roof trusses. Prefabrication of walling components such as panels have proved to be commercially viable in many developing countries, e.g. in Kenya, Mexico, Zimbabwe, and in the Philippines.

1/ The Global Strategy For Shelter To The Year 2000, UNCHS, 1990, HS/185/90/E.

5. One special technical merit of wood as a material for shelter construction is that in most developing countries there already exists some basic local infrastructure: chain-saw operators felling timber, saw-millers dealing in primary processing, and joinery workshops dealing in secondary processing albeit with relatively simple equipment and techniques but, nevertheless, yielding valuable components for timber construction. Similarly, in almost all building sites, basic carpentry skills are already available. There is also some local knowledge and practice of seasoning of timber and preservative treatments even though much scope exists for introducing new techniques to improve efficiency and effectiveness.

6. From the socio-economic point of view, wood offers several advantages over other comparable building materials. In the backdrop of continued import dependence of building materials industries, in most developing countries, timber construction, using locally available species, requires little dependence on foreign exchange, and its labour-intensive character provides opportunities for employment generation and rural industrialization. It is also to be noted that developing countries are facing increasingly stiffer competition from temperate species of the industrialized countries in Europe and North America in exporting their timber for use in construction. On the other hand, domestic housing and construction should provide an important market for plantation species and CLAS from natural forest.

7. From a financial point of view, timber construction in housing has proven to be cost-effective over other construction techniques using predominantly indigenous materials. In Colombia, Ecuador and Peru, timber-based house construction has led to cost reduction between 10 and 18 per cent over traditional construction using blockwork, cement and steel. Cost comparisons for Andean Pact countries indicate even higher cost reduction potential of timber construction. In Rangoon City, traditional timber-frame structures with brick-filled walls achieve 25-28 per cent savings over reinforced concrete structures, and 10-16 per cent over masonry structures.2/

8. In considering wood as a cost-effective building material, special attention must be given to the yet untapped potential of CLAS and certain plantation species, in countries endowed with these resources, to serve as a sustainable source of indigenous material in meeting the construction requirements of shelter and physical infrastructure development. For a variety of reasons, these species - more than the commercial timber species - hold the key to a successful strategy for greater utilization of wood in housing and construction.

9. FAO estimates that selective harvesting of commercial species in the tropical forests has led to the utilization of only 5.4 per cent of the standing volume.3/ An important result of greater exploitation of CLAS from

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2/ See Annex 1.

3/ O.P. Hansson, Promotion of Commercially Less-accepted Species, UNIDO, ID/WG.395/1, 1983.

tropical forests would be the increase in volume and value extracted per hectare, reduction in the unit cost of extraction, and, most importantly, the lengthening of the lifetime of the natural forest.

10. The growing volume of industrial plantations, which now occupy an estimated 48 million hectares and is annually growing at a rate of about 2 million hectares[4/] (and in tropical regions, even larger areas can be brought under coniferous plantations of rapid growing species to keep pace with the rising demand), can, with proper forestry and timber conversion practices, serve as a renewable source of an indigenous construction resource in many developing countries, particularly, in Asia but also in Brazil and Chile. While the supply of softwood from coniferous species (which constitute around half of 35 million hectares of industrial plantations in Asia) has to meet the demand from competing industrial sectors (e.g., paper, matchbox, packaging industries etc.), the extensive rubber and coconut plantations in India, Indonesia, Malaysia, Philippines, Thailand and Sri Lanka can yield significant quantities of rubber wood and coconut wood to service the domestic construction market. In the Philippines alone, the annual yield of coconut stem is around 6 million cubic meters, in Sri Lanka, some 430,000 cubic meters, and about 32,000 tonnes in Malaysia.[5/] Similarly, overmatured trees from rubber plantations (Malaysia alone has about 2 million hectares under rubber plantations) can ensure a regular supply of timber that can be used for joinery, roof trusses, flooring, and in laminated sections after seasoning and preservative treatment using simple dip diffusion methods.

11. Even though the marketing channels for CLAS and some of the plantation species (e.g. rubber wood, coconut wood etc.) are yet to be fully established in most developing countries, the distinct price advantage of these species over the commercial species is quite clear.[6/] For one, the dwindling supply of the commercial species of tropical hardwoods, their export potential, and the demand for these species exerted by the upper end of the market, raise their price in the domestic market to a level that can hardly be afforded by the low-income groups for their shelter needs. In contrast, both logs and sawnwood yielded by CLAS and the plantation species are available in relative abundance and they almost exclusively cater to the domestic market. Specifically, if the CLAS are grouped, these can be used by proximate markets reducing transportation costs. All these factors make CLAS and plantation species particularly suited to meet the construction needs in developing countries.

4/ A.J. Ewing and R. Chalk, The Forest Industries Sector: An Operational Strategy for Developing Countries, the World Bank, Washington, D.C., 1988, p.18.

5/ UNCHS Consultant's Report (Unpublished), 1990.

6/ O.P. Hansson, op. cit. p.21.

12. Recent studies indicate that the strength properties of several commercially less-accepted species compare well with the commercial species. In Sri Lanka, CLAS such as Alstonia, Seligna, Ginisapu etc.(which are known to have a commercially viable standing volume in natural forests) exhibit bending and compressive strengths comparable to, and sometimes, in excess of those exhibited by commercial species such as Teak, Mahogany, Jack, Palu etc. Similarly, in the Philippines, plantation species such as Pine and Bagras exhibit strength properties comparable to those of Apitong and Lauan, conventionally used in construction. What is, perhaps, more important, is that the minimum strength of most of the CLAS and plantation species are well above that demanded by the strength requirements of low-rise construction.

13. A particular advantage of CLAS and plantation species is their suitability for use in pole construction, particularly for low-income shelter. Thinings from softwood plantations and logs from a variety of commercially less-accepted species can be used for pole frame construction to erect structures on flat land, on hillsides, over streams and ravines, or on marshy and swampy grounds, wherever low-cost shelter projects are undertaken. Because of its versatility, pole frame construction for housing has been standardized in New Zealand using treated roundwood of Radiata Pines.7/ Pole frame construction using CLAS has also been popularised in Papua New Guinea.8/

14. Together with CLAS and plantation species, certain species of bamboo merits close consideration as one of the fastest growing and highest yielding renewable natural resource that can be harnessed for housing and construction in developing countries. The ease with which it can be worked with, its versatility, strength, and the short harvesting cycle of about 5 years, makes it particularly suited for low-cost housing as demonstrated in a number of countries of Asia, South America, and Central America, most notably, in Costa Rica, where the National Bamboo Project, supported by UNCHS and the Government of the Netherlands, has established a replicable programme of bamboo house construction, mainly, through community and self-help, at costs that can be afforded by the low-income groups.9/

15. Another potential raw material for the building materials industry is the waste generated by the primary wood processing industries through logging operations and by the saw mills. It is estimated that logging wastes in the form of damaged residuals, tree tops and branches, high stumps and abandoned

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7/ Construction of Pole-system Housing: Timber and Wood Products Manual, TRADA, Wellington, 1976.

8/ Pole Buildings in Papua New Guinea, Forest Products Research Centre, Department of Forests, Papua New Guinea, 1975.

9/ World Resources, 1990-91, The World Resources Institute, Washington, D.C., 1990, p.80.

logs can be as high as 0.8 cubic meter for every cubic meter of log removed from the forest. Mill wastes are around 0.5 cubic meter for every cubic meter fed into a sawmill or a plywood mill.10/

II. Existing barriers to greater use of wood, including CLAS and plantation species in housing and construction

16. Even though promotion of commercially less-accepted species, and greater utilization of wood in construction, have been debated over the years and some of the member governments have made noteworthy efforts in this direction, the full potential of wood, particularly, CLAS and plantation species, as a sustainable source of indigenous building material is yet to be fully realized. A host of factors have contributed to this situation which can be broadly grouped as: (a) prejudices against use of wood in housing and construction, (b) lack of adequate technical information and regulatory instruments necessary for proper use of the material by the industry, (c) lack of appropriate technology and inadequate industrial infrastructure, and (d) ineffective government policies. Acting together, these factors constitute an effective barrier against greater utilization of wood in housing and construction. Further analysis under this section elaborates on the nature and operation of these factors.

(a) Prejudices against use of wood in housing and construction

17. Despite the long history of use of wood in construction, in both developed and developing countries, and the accepted use of wood in house construction in some industrialized countries in Europe and North America, prejudices still exist in the developing countries with regard to wide adoption of wood in construction. These prejudices are not only restricted to end-users but extend to specifiers, stockists, and agencies engaged in housing finance. Primarily, these prejudices relate to the fire-resistance and durability of wood. Even though in industrialized countries, the wide acceptance of wood in construction is the result of established fire-safety practices - ranging from appropriate architectural and design provisions to protective linings in hazardous areas - and preservative treatments with assured life expectancy (for example, pole frame houses in New Zealand using Radiata Pine poles treated to NZ TPA specification have an assured life expectancy in excess of 80 years,11/ such practices are absent or are unreliable in most of the developing countries, specifically the use of treated timber for foundations. The result is that in many developing countries, banks and insurance agencies are reluctant to finance timber construction or charge higher premium for such construction. This is a crucial problem which must be resolved through the introduction of improved practices if CLAS and plantation species are to be successfully promoted for construction. Most demonstration projects

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10/ Logging and Processing Residues: Their Potential. Industrial Forestry Task Force, Forestry Development Centre, UPLB, Philippines, 1989.

11/ TRADA: Ibidem.

organised by government agencies have failed to create a favourable impact for lack of good practices and for their inability to demonstrate the competitive position of timber in construction in relation to other building materials that it can replace. The demonstration of cost-effectiveness of timber in construction is very important and this should be done using a methodology that is accepted by the industry and is replicable in other projects.

18. Prejudices also arise because of uncertain quality of timber and when the supply of particular species is irregular and unreliable. Stockists and sawmillers are usually hesitant to stock lesser-known species, unless these have established end-uses and their regular supply is assured. The reasons for the failure of CLAS and plantation species to effectively penetrate the construction market are the excessive reliance placed on its price advantage alone, and the negligence to stock timber for construction, the more so lesser-known species, which have greater resemblance to established species or those that possess special properties which make them attractive for particular end-uses.

(b) Lack of technical information and regulatory instruments

19. An important constraint that inhibits the confident use of wood in structural applications, by designers and specifiers, is the lack of reliable technical information relating to its strength and deformation characteristics. Most species have sufficient strength data to permit their use in shelter and load-sharing constructions, but in many cases it is insufficient for highly stressed members and timber engineering in its broader sense. Also, much work needs to be done to establish timber engineering design codes suitable for developing countries which would allow promotion of timber construction with the minimum of delay but at the same time would be formulated in such a way as to be able to be harmonized with international codes (e.g. EUROCODE 5) at a later stage.

20. The heterogeneity of tropical timber and the large number of disparate commercially less-accepted species pose a special marketing problem. In the context of promoting these species for the construction market, the practice of grouping these species together, based on strength or end-use criteria, is required to be established in developing countries. Visual stress grading is seldom practiced and even though machines for stress grading or proof loading exist, these are expensive and relatively sophisticated for wide use.

21. The lack of technical information is compounded by inadequate efforts in most developing countries to diffuse available information to the industry in a manner and form that could be readily utilized by designers, specifiers etc. Simple, clear standards and codes of practice, suitably illustrated design manuals and detailing aids can facilitate the work of designers, field supervisors and craftsmen, thus creating a favourable atmosphere for use of wood in construction. Research institutes have come up with such design manuals, but such manuals (for example, the manual on use of coconut wood in

construction prepared by UNIDO),[12] have not been sufficiently popularised through workshops, short-term refresher courses etc. Government departments have done little to train or familiarise construction staff in timber construction practices to promote cost-effective use of wood available in local markets. Education of civil engineers and architects in timber engineering has also been neglected.

22. The lack of appropriate building legislation, supported by standards and codes of practice for use of timber in construction, is another serious constraint in promoting greater use of wood, particularly, CLAS and plantation species in housing and construction. In some countries, existing municipal building codes do not include timber as a building material and thus, effectively exclude its use in government-sponsored housing programmes. In most developing countries, the codes of practice are derived from code of developed countries (with which they had colonial links) and are unduly restrictive of the use of locally available species (particularly, coconut wood which is abundantly available in most of these countries) which could otherwise be profitably utilized in low-income housing.[13] An important consequence of inappropriate building regulations is that the banking and insurance agencies, which rely solely on these regulations, fight shy of financing or insuring timber construction thus effectively restricting both private and public initiative to promote timber in house construction.

(c) Lack of technology and inadequate industrial infrastructure

23. In the area of appropriate technology, and industrial infrastructure for processing of timber for construction, there are several gaps in most of the developing countries. Rudimentary technologies for both primary and secondary wood processing are used in most countries, leading to chronic low productivity and gross inefficiencies in the industry which, ultimately affect the economic viability of most enterprises. For example, even though some developing countries, notably, Venezuela and the Philippines have solved the problems of sawing high density CLAS of timber,[14] rudimentary practice using two-man ripsaw is still widely used in several Pacific Island countries resulting in extremely low recovery of dimension sawn -lumber. In the area of secondary processing also, affordable, modern, small-scale technologies to process CLAS and plantation species into panels for wall-cladding and roof shingles are not easily available to small entrepreneurs. In advanced level

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12/ R.N. Palomar and J.O. Siopongco, Technology Manual on Coconut Wood as Construction Material, UNDP/UNIDO Regional Network in Asia-Pacific for Low-cost Building Materials Technologies and Construction Systems.

13/ H.P. Brion, Secondary Wood Processing in Asia and the Pacific, UNIDO, ID/WG.500/4(SPEC), 1990, p.51.

14/ Promoting Secondary-wood Species in Support of the Global Shelter Strategy, UNCHS, 1990.

of secondary processing such as for composite materials, e.g. wood-chip boards and wood-cement panels, because of investment constraints the existing machinery is usually at a scale that is not commensurate with the effective demand of the local market.

24. In the area of preservation and treatment against bio-degradation, an array of technologies - from rudimentary through small-scale to sophisticated - are available in the international market. However, in many countries, these technologies are not used in a cost-efficient manner by the small-scale sector of the secondary processing industries. Portable solar kilns, fabricated with locally available materials, can drastically reduce the seasoning cost of any timber,15/ but their adoption is still restricted to a few countries.

III. Final considerations

25. Section I of this paper outlines the rationale for greater utilization of wood, particularly, CLAS and plantation species, in construction. Section II, then, proceeds to analyse the key constraints that currently inhibit greater contribution of the wood processing industry to construction, in particular, to the shelter sector. The Consultation may like to focus its attention on these key constraints, and then, deliberate on the policies, strategies and practical measures that could be adopted by member governments and the international community to enhance the role of the secondary wood processing industry in the growth of housing and construction in developing countries.

26. In the areas of national policies and strategies, the Consultation might wish to highlight the need for greater efforts to promote CLAS and plantation species, more funding for research and dissemination of technical information to the industry and as concerns individual countries that consideration be given to ensure that building codes are adopted which take into account the merits of wood as a building material.

27. The Consultation may wish to affirm that greater use of wood in construction is consistent with the environmentally sound management and the use of the tropical forest and to emphasize in particular the role of CLAS and plantation species could play in this regard. It may then wish to affirm that the following measures would be likely to increase the use of CLAS and plantation species:

(i) Improving the quality of technical information on the use of wood, and particularly of CLAS and plantation species, in construction;

(ii) Improving the methods by which information is placed at the disposal of designers, builders, specifiers, and end-users in the construction and wooden building components industries;

15/ Solar Seasoning Kiln for Sri Lanka, UNCHS Project Report (Unpublished), 1989.

(iii) Ensuring that there exist effective and clear wood construction standards or codes, which embrace such items as grading, dimensioning, preservation, fire safety, and ability to withstand earthquakes;

(iv) Improving the training of graders, designers, detailers, and others, such as management and certain governmental officials. Such training programmes should relate to the requirements of those working directly in the construction industry and those in the industrial sector who are producing wooden components for the construction sector. Key personnel in government and various support industries such as finance and insurance should also be trained in the evaluation of wooden construction techniques;

(v) Using carefully designed demonstration projects to illustrate the strengths of wood, and particularly CLAS and plantation species, as a construction material;

(vi) Improving information concerning potential commercially viable supplies of CLAS and plantation species, would be helpful in developing markets for these woods. Such information would also help to focus research and development activities on those woods which ultimately could be expected to have a significant market potential;

26. The Consultation may like to lay emphasis on three areas requiring institutional support. First, there is a need for supporting research effort in developing countries aimed at (i) establishing reliable design parameters for tropical species, particularly, CLAS and plantation species, (ii) developing low-cost techniques for seasoning and preservative treatment, and improving fire-resistance of wood construction, and (iii) popularising simple field-identification techniques for tropical species, particularly, CLAS. Secondly, effort is needed to ensure commercialization of research results. The value of product promotion has been amply demonstrated in the case of rubber wood in Malaysia, where it has been developed from a source of fuel-wood to a competitive material for furniture-making. Instead of relying solely on price advantage for marketing promotion of CLAS and plantation species, attention should be given to standardizing and grouping of species based on strength and specific end-use. Thirdly, achievements in the area of timber technology, in a number of timber producing developing countries, provide a promising basis for South-South co-operation. For example, rubber wood technologies developed in Malaysia can be gainfully used by such rubber producing countries as Ghana, Liberia, and Nigeria. Similarly, bamboo construction techniques developed in China, Colombia and Costa Rica and research work carried out in the Netherlands can accelerate low-cost shelter delivery programmes in a number of countries. North-South co-operation would benefit the developing countries in such areas as timber resource assessment, nomenclature, grading rules, standardisation and modularisation of dimensions.

Annex 1

Cost per unit floor area of different types of structures in Yangoon, Myanmar, with advantages and disadvantages

No.	Type of structure	Cost per unit area Kyats per sq. ft.	Advantages & disadvantages
1.	Masonry structure with load bearing walls	180 - 220	Walls are thick enough to carry loads and absorb heat during day time and transmit it indoors during the evening. Less earthquake resistant than other structures.
2.	Reinforced-concrete frame structure with brick filling walls	200 - 280	Good thermal performance, good earthquake resistance, most expensive of all types.
3.	Timber-frame structure with brick filling walls (brick nogging structures)	150 - 200	Good thermal performance, good earthquake resistance. Durability subject to quality of timber used.
4.	Timber-frame structure with timber walling	40 - 60	Good thermal performance, good earthquake resistance. Shorter life than masonry structure, about 80 years, flammable.
5.	Bamboo structure or mixed timber and bamboo structure	6 - 10	Good thermal performance, good earthquake resistance. Shortest life and highly flammable.

Source: Yangoon City and Regional Development Project, UNCHS (Habitat) unpublished report, 1985.